

**GOVERNMENT OF PUERTO RICO
PUBLIC SERVICE REGULATORY BOARD
PUERTO RICO ENERGY BUREAU**

NEPR

Received:

Feb 2, 2022

11:00 PM

IN RE: REVIEW OF THE PUERTO RICO
ELECTRIC POWER AUTHORITY'S 10-
YEAR INFRASTRUCTURE PLAN –
DECEMBER 2020

CASE NO.: NEPR-MI-2021-0002

SUBJECT: Third Motion to Submit
Additional Generation Projects SOWs

THIRD MOTION TO SUBMIT ADDITIONAL GENERATION PROJECTS SOWS

COMES NOW the Authority¹, through its counsel of record, and respectfully submits and requests as follows:

I. RELEVANT BACKGROUND

On November 15, 2021, PREPA filed a *Motion to Submit Fourth Group of Generation Projects* (the “November 15 Motion”), with a comprehensive list of Generation Projects which consist of repair work projects of generation assets and for which PREPA will seek reimbursement under several FEMA programs. November 15 Motion at Attach. A.

After several procedural events, PREPA was served with the January 4 Order, by which the Energy Bureau conditionally approved the projects described in attachments A to H of the referenced order (“Conditionally Approved Projects”), pending the submittal by PREPA of the SOW of each project and deferred the approval of projects are listed in Attachment I of the January 4 Order (the “Deferred Projects”) until further evaluation. The January 4 Order additionally provides directives regarding both set of projects for which PREPA was ordered to submit on January 14, 2022, the SOW for both the Conditionally Approved Projects and the Deferred Projects for the Energy Bureau’s evaluation. January 4 Order at p. 3, Sec. III. Additionally, the

¹ Capitalized terms not defined herein shall be considered with the meaning provided to them in the January 28 Motion.

Energy Bureau directed PREPA to answer, on or before January 19, 2022, a set RFIs listed in the order.

On January 13, 2022, PREPA submitted a motion titled *Partial Compliance with the January 4 Order and Request for Extension of Time* (the “January 13 Motion”) together with a total of 25 “Generation Projects SOWs” for the review and approval of the Energy Bureau. January 13 Motion at Attach. A. Further, PREPA requested an extension of time until February 14, 2022, to submit the Outstanding SOWs. PREPA asserted that, even though it was asking until February 14, 2022, to complete the submittal of the Outstanding SOWs, it was going to submit them on a rolling basis as they were completed and approved by PREPA.

Thereafter, on January 18, 2022, PREPA filed *Request for Extension of Time to Submit Responses to RFI Included in the January 4 Order* (the “January 18 Motion”) asking the Energy Bureau to grant until February 14, 2022, to submit the responses to the RFI.

On January 22, 2022, the Energy Bureau entered an order granting, *inter alia*, the requests for extension made by PREPA in the January 13 and January 18 motions. Therefore, the operative deadline to file the Outstanding SOWs and responses to the RFI is February 14, 2022.

On January 25, 2022, PREPA submitted to the Energy Bureau the *Motion to Submit Additional Generation Projects SOWs* with 10 additional Generation Projects SOWs. Thereafter, on January 28, 2022, PREPA submitted a *Second Motion to Submit Additional Generation Projects SOWs* (the “January 28 Motion”) with 20 additional Generation Projects SOWs.

To date, the Energy Bureau has not ruled on the January 13, 25 and 28 motions and the Generation Projects SOWs presented for its approval.

II. SUBMITTAL OF ADDITIONAL GENERATION PROJECTS SOWS

In compliance with the January 4 and January 18 orders, PREPA completed a total of 14 additional Generation Projects SOWs which are submitted herein for the review and approval of the Energy Bureau. Attach. A. Out of these Generation SOWs, 12 pertain to the Conditionally Approved Projects, while 2 pertains to the Deferred Projects.

To facilitate the evaluation of the Generation Projects SOWs submitted, PREPA hereby includes a table that details and breakdowns the SOWs as follows: project number assigned by the Energy Bureau to each Generation Project SOW (first column), the SOW number assigned by PREPA (second column), project name (third column) and a summary of the proposed scope of work (fourth column). *See*, Attach. B.

With this submittal, PREPA has tendered a total of 69 Generation Projects SOWs to the Energy Bureau.

III. REQUEST FOR APPROVAL OF THE GENERATION PROJECTS SOWS

PREPA respectfully request the Energy Bureau to approve the Generation Projects SOWs as submitted herein. As stated in several submittals, PREPA's goal to move in a direction that leads to lower costs and cleaner energy requires maintaining its system's reliability and stability during such transition. Consequently, the Generation Projects SOWs submitted for the review and approval of the Energy Bureau consist of repair works *necessary* to increase the current dependable available generation and provide the People of Puerto Rico a safe and reliable electrical service – while the integration of reliable new resources is completed– and thus prevent future major outages in compliance with the SOP and POR reliability criteria. In conclusion, the proposed Generation Projects are *crucial* for PREPA to maintain the reliability of the generation system during the

process of integrating new resources and therefore, PREPA requests the Energy Bureau to approve the Generation Projects SOWs submitted herein.

Should the Energy Bureau have any concerns or questions regarding the Generation Projects SOWs herein submitted, PREPA respectfully request that a technical conference through which PREPA representatives can discuss the Generation Projects SOWs be scheduled. During the proposed conference, PREPA's personnel shall address any concerns or questions the Energy Bureau may have, so these projects are approved and PREPA can move forward and make the relevant funding requests to COR3 and FEMA.

IV. REQUEST FOR CONFIDENTIAL DESIGNATION AND TREATMENT

The Generation Projects SOWs presented herein contain global positioning system ("GPS") coordinates of PREPA's power plants, which is critical energy infrastructure information ("CEII") that cannot be disclosed to the public (*i.e.*, Attach. A, SOW 1012, p. 49 at secs. 2.1, 10.3, respectively). To protect such confidentiality, PREPA has redacted the GPS information from the Generation Projects SOWs herein submitted (Attach. A) and requests the Energy Bureau to determine that the GPS information is CEII and thus, confidential, and to maintain the public files with the redaction already provided.

The following is a detailed list of the information that PREPA asserts is confidential and must be kept under seal:

SOW NO.	PROJECT DESCRIPTION	CONFIDENTIAL INFORMATION	LEGAL BASIS
1012	Fuel Service Tank S-10 Rehabilitation, San Juan Steam Plant	GPS Location Page 4, Sec. 2.1 Page 9, Sec. 10.3	CEII
1013	Unit 5 SCR Ammonium Procurement San Juan Power Plant	GPS Location Page 4, Sec. 2.1	CEII

SOW NO.	PROJECT DESCRIPTION	CONFIDENTIAL INFORMATION	LEGAL BASIS
		Page 9, Sec. 10.3	
3049	Procurement of Water Heater 5 (Deaerator) Spare Pump Costa Sur Power Plant	GPS Location Page 4, Sec. 2.1 Page 9, Sec. 10.3	CEII
3053	Procurement of Induced Draft Fan (IDF) and Forced Draft Fan (FDF) Spare Motors for Units 5 and 6	GPS Location Page 4, Sec. 2.1 Page 9, Sec. 10.3	CEII
3054	Condensate Pump (CP) Motor, Costa Sur Power Plant – units 5 and 6	GPS Location Page 4, Sec. 2.1 Page 9, Sec. 10.3	CEII
3057	4160V Electric Cable, Costa Sur Power Plant – Unit 5	GPS Location Page 4, Sec. 2.1 Page 9, Sec. 10.3	CEII
3066	AGC Replacement Project Costa Sur Unit 5 and 6	GPS Location Page 4, Sec. 2.1 Page 8, Sec. 10.3	CEII
3067	Natural Gas Igniters for Costa Sur Units 5 and 6	GPS Location Page 4, Sec. 2.1 Page 9, Sec. 10.3	CEII
4076	Palo Seco Steam Plant New Water Condensate 1-2 Tank	GPS Location Page 4, Sec. 2.1 Page 9, Sec. 10.3	CEII
4081	Boiler, Generator & Turbine Repairs, Palo Seco Steam Plant – unit 3	GPS Location Page 4, Sec. 2.1 Page 9, Sec. 10.3	CEII
6088	Unit 1 Rehabilitation, Cambalache Power Plant	GPS Location Page 4, Sec. 2.1 Page 10, Sec. 10.3	CEII
6089	Control System and Power Plant Maintenance Consulting Services for Cambalache Units 1 and 2	GPS Location Page 4, Sec. 2.1 Page 11, Sec. 10.3	CEII

SOW NO.	PROJECT DESCRIPTION	CONFIDENTIAL INFORMATION	LEGAL BASIS
6090	AVR & SFC Upgrade, Cambalache Power Plant – units 2 and 3	GPS Location Page 4, Sec. 2.1 Page 9, Sec. 10.3	CEII
6091	Units 1, 2, 3 Inspections, Cambalache Power Plant	GPS Location Page 4, Sec. 2.1 Page 10, Sec. 10.3	CEII

Article 6.15 of the *Puerto Rico Energy Transformation and RELIEF Act*, Act no. 57 of 2014, as amended (“Act 57”)², provides that “any person who is required to submit information to the Energy [Bureau] believes that the information to be submitted has any confidentiality privilege, such person may request the [Bureau] to treat such information as such[.]” *Id.* at Sec. 6.15. “If the Energy [Bureau], after the appropriate evaluation, believes such information should be protected, it shall grant such protection in a manner that least affects the public interest, transparency, and the rights of the parties involved in the administrative procedure in which the allegedly confidential document is submitted.” *Id.* at Sec. 6.15(a). If the Energy Bureau determines that the information is confidential, “the information shall be duly safeguarded and delivered exclusively to the personnel of the Energy [Bureau] who needs to know such information under nondisclosure agreements.” *Id.* at Sec. 6.15(b). “The Energy [Bureau] shall swiftly act on any privilege and confidentiality claim made by a person subject to its jurisdiction by means of a resolution to such purposes before any allegedly confidential information is disclosed.” *Id.* at Sec. 6.15(c).

Pursuant to its vested powers, the Energy Bureau approved the *Regulation on Adjudicative, Notices of Compliance, Rate Review, and Investigations Proceedings* (“Regulation 8543”).³

² *Puerto Rico Energy Transformation and RELIEF Act*, Act no. 57 of May 27, 2014, 22 L.P.R.A. §§ 1051-1056.

³ Energy Bureau, *Regulation on Adjudicative, Notices of Compliance, Rate Review and Investigations Proceedings*, No. 8543 (December 16, 2015).

Regarding the safeguards that the Energy Bureau gives to confidential information, Regulation 8543 provides that:

[i]f in compliance with the provisions of [Regulation 8543] or any of the Energy Bureau's orders, a person has the duty to disclose to the Energy Bureau information considered to be privileged pursuant to the Rules of Evidence, said person shall identify the allegedly privileged information, request the Energy Bureau the protection of said information, and provide supportive arguments, in writing, for a claim of information of privileged nature. The Energy Bureau shall evaluate the petition and, if it understands the material merits protection, proceed according to what is set forth in Article 6.15 of Act No. 57-2014, as amended.

Regulation 8543 at Sec. 1.15.

Federal and Puerto Rico law protect the confidentiality of CEII, the public disclosure of which may pose a security threat in that the information could be useful to a person or group in planning an attack on critical infrastructure. *See, e.g.*, 18 C.F.R. § 388.113, as amended by Federal Energy Regulatory Commission ("FERC") Order No. 683, *Critical Energy Infrastructure Information* (issued September 21, 2006); *USA Patriot Act of 2001*, § 1016, creating the *Critical Infrastructures Protection Act of 2001*, including 42 U.S.C. § 5195c(e) (defining Critical Infrastructure). FERC regulations subject such information to limitations on use and disclosure to "ensure that information deemed CEII stays out of the possession of terrorists." 18 C.F.R. § 388.113(d)(4). *Off. of People's Counsel v. Pub. Serv. Comm'n.*, 21 A.3d 985, 991, Util. L. Rep. P 27157, 2011 WL 2473405 (D.C. App. 2011).

Under the Critical Infrastructures Protection Act of 2001, the term "critical infrastructure" means "systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters." 42 U.S.C. § 5195c(e). In 2006, FERC Order no. 683 amended the regulations for gaining access

to CEII and simplified procedures for obtaining access to CEII without increasing vulnerability of the energy infrastructure and ensuring that access to CEII does not facilitate acts of terrorism.

A utility is not required to obtain FERC or other federal government approval to designate information as CEII. For example, information required by FERC's Annual Transmission Planning and Evaluation Report, Form No. 715 ("FERC No. 715"), is *de facto* considered CEII and is automatically afforded the heightened protections. FERC No. 715 requires that any transmitting utility that operates integrated (non-radial) transmission facilities at or above 100 kV must annually submit information including but not limited to: Power Flow Base Cases, Transmitting Utility Maps and Diagrams, Transmission Planning Reliability Criteria, Transmission Planning Assessment Practices, and Evaluation of Transmission System Performance. Any utility that submits the required transmission information pursuant to FERC No. 715 does so with the knowledge that, as stated in the Form's Instructions, FERC "considers the information collected by this report to be CEII and will treat it as such." *See also* 18 C.F.R. § 141.300(d) relating to the Form and CEII.

Mainland regulators typically do not require a utility that designates material as CEII to follow any process before the federal government to make or support such a designation, and, further, that the regulator, in its informed discretion, can establish limits on how information that it considers CEII can be accessed.

Furthermore, and regarding the foregoing argument, FERC has ruled on several occasions that GPS coordinates of any project features "qualify as CEII because it provides more than just location." *See e.g.*, Final Rule, Docket Nos. RM02-4-000, PL02-1-000; Order No. 630, Note 31, entered on February 21, 2003 (ruling that FERC considered the global positioning system coordinates of any project features (precise surveyed or GPS coordinates at or above two decimal

points of accuracy of equipment and structures) gas information to qualify as CEII because it provides more than just location).⁴

The aforementioned request for relief has been granted in other matters and dockets, and for requests made under the captioned case, in which PREPA has had to produce information that included CEII, more specifically GPS. For example, two weeks ago PREPA submitted January 13 Motion, which included several statements of works like the Generation Projects SOWs tendered with this motion. The January 13 Motion Generation Projects SOWs included GPS information that PREPA redacted from the public filing and asserted that should remain under seal and declared confidential because, pursuant to federal and local law, it qualified as CEII. After evaluating PREPA's arguments, on January 21, 2022, the Energy Bureau granted confidential designation and treatment to the GPS information that had been redacted from the public versions of the filing. January 21 Order at pp. 3-5, Sec. III.

Is its respectfully submitted that the redacted GPS information qualifies as CEII and thus, should remain redacted. Furthermore, it is asserted that the redactions made are the manner that least affect the public interest, transparency, and the rights of the parties involved in this administrative procedure. *See*, Act 57-2014 at Sec. 6.15(a). Accordingly, and pursuant to the above, it is respectfully requested that the Honorable Energy Bureau find that the information identified by PREPA as CEII is confidential and that the Secretary of the Energy Bureau be directed to keep the confidential CEII under seal.

⁴ Federal Register: March 3, 2003 (Volume 68, Number 41); Rules and Regulations, pp. 9857-9873.

V. CONCLUSION

WHEREFORE, PREPA respectfully requests the Honorable Energy Bureau to determine that PREPA has partially complied with the January 4 and January 21 orders; to approve the Generation Projects SOWs as submitted herein; to schedule a technical conference to discuss the submitted Generation Projects SOWs, if the Energy Bureau deems it necessary; to determine that the GPS information redacted from Attachment A is CEII and thus, confidential information; and to enter an order directing the Secretary of the Energy Bureau to maintain the CEII under seal.

RESPECTFULLY SUBMITTED.

In San Juan Puerto Rico, this 2nd day of February 2022.

s/ Maralíz Vázquez-Marrero

Maralíz Vázquez-Marrero

mvazquez@diazvaz.law

TSPR No. 16,187

s/ Katuska Bolaños-Lugo

Katuska Bolaños-Lugo

kbolanos@diazvaz.law

TSPR No. 18,888

DÍAZ & VÁZQUEZ LAW FIRM, P.S.C.

290 Jesús T. Piñero Ave.

Oriental Tower, Suite 803

San Juan, PR 00918

Tel. (787) 395-7133

Fax. (787) 497-9664

CERTIFICATE OF SERVICE

It is hereby certified that I have filed the foregoing with the Clerk of the Energy Bureau using the electronic filing system using <https://radicacion.energia.pr.gov/login> and also, that I have served a copy on LUMA Energy, LLC and LUMA Energy ServCo, LLC through their counsel of record at laura.rozas@us.dlapiper.com and margarita.mercado@us.dlapiper.com.

In San Juan Puerto Rico, this 2nd day of February 2022.

s/ Katuska Bolaños-Lugo
Katuska Bolaños-Lugo

Attachment A

Government of Puerto Rico

Puerto Rico Electric Power Authority



Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES
Submittal to COR3 and FEMA



***Fuel Service Tank S-10 Rehabilitation,
San Juan Steam Plant***

1/31/2022



Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes



Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	San Juan Steam Plant – Fuel Service Tank S-10 Rehabilitation
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number (Formerly Project Worksheet)	136271 - MEPA078 PREPA Island Wide FAASt Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: <Name>

<Insert title here>

PREPA Project Sponsor: <Name >

<Insert title here>



Section 2. Facilities

2.1. Facilities List

Name	GPS Location
San Juan Steam Plant, Tank S-10	[REDACTED] [REDACTED]

Note: GPS coordinates are required for all facilities.

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

San Juan Steam Plant needs to rehabilitate and return to service its Fuel Oil #6 Service Tank S-10, since it is empty and has been exposed to the environment for a long time, which promotes deterioration due to corrosion. Rehabilitation includes structural steel repairs of floor, roof, shell, columns and beams elements, and application of new anti-corrosive coating on the interior and exterior of the tank.

Section 3. Scope of Work

3.1. Scope of Work Description

The scope of work for the Fuel Service Tank S-10 Rehabilitation of San Juan Steam Plant will consist of the following:



- A. New anchors design calculation shall be performed using API-650 latest edition and using a Seismic Use Group III (SUG III), Importance factor (I) of 1.5. Contractor shall include the installation of any additional anchor based on the calculation results.
- B. Repair undercut (0.250") at the internal manual level pipe support as per API-653 section 9.6.
- C. Repair bottom plate #4 with a 24" x 12" welded on plate as per API-653 section 9.3.
- D. Repair undercut (0.500") at nozzles N3 (4"Ø) as per API-653 section 9.6.
- E. Replace ten (10) stairway steps identical to the existing ones.
- F. Replace twenty (20) stairway steps support bars identical to the existing ones.
- G. Replace the stairs top landing platform.
- H. Replace the two roof nozzle flanges located adjacent to the top platform and also their corresponding mate flanges. All gaskets, bolts, nuts and washers shall be replaced.
- I. Replace the existing illumination system including wiring, conduit, poles and luminaires.
- J. Provide a new tank reconstruction nameplate in accordance with API-653 section 13.1.
- K. Install a new float and tape transmitter for tank level measuring.
- L. Install a new liquid level indicator (target and gauge board).
- M. Installation of 10 (12" x 12") insert plates for roof or shell repairs, total of 10 ft² of repair plate area.
- N. Installation of 10 (12" x 12") lap patches for bottom repairs, total of 10 ft² of repair plate area.
- O. Include 20 linear feet of shell to bottom weld repair (or any butt weld) and 20 linear feet of bottom weld repair (or any fillet weld).
- P. All flanges shall be refitted with new gaskets, bolts, nuts and washers.
- Q. After coating removal all bottom and shell to bottom welds shall be vacuum tested.
- R. All telltale holes shall be cleaned and pneumatically tested.
- S. All scaffolding shall be inspected, certify and tagged with the corresponding labels.
- T. Besides the coating work on the tank interior and exterior shell, the Contractor shall paint up to the next flange face and all welded support structure. Railings, gratings and stairs shall also be included.

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards:** Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project:** Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
 - a. Other improvements, not required by codes and standards
 - b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)


Choose One (Restoration, Improved or Alternate)

If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.

Restores to Codes/Standards

Note: If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.

3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?

4.1. Codes, Specifications, and Standards

Yes/No. If yes, describe how incorporated below.

- (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE)
- (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE)
- Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730-B2 - U.S. Department of Agriculture Rural Electric Service (RUS)
- International Building Code (IBC) - International Code Council (ICC)
- International Energy Conservation Code (IECC) - International Code Council (ICC)
- International Existing Building Code (IEBC) - International Code Council (ICC)
- National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers
- National Electrical Code (NEC) - National Fire Protection Association (NFPA)
- FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards


Yes/No. If yes, describe how incorporated below.

- 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA)
- 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA)
- ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE)
- International Building Code (IBC) - International Code Council (ICC)
- Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA)
- Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA)
- RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS)
- Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.

Cost Type	Amount (\$)
Tank S-10 Rehabilitation	\$647,000.00
Total Project Estimated Cost	\$647,000.00

Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: If available, detailed engineering cost estimates will be included as an attachment.

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.



Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

Program Manager's Printed Name

Date

Title

Signature

Section 9. PREPA Project Sponsor Comments

Comments
<Insert any comments here>

PREPA Project Sponsor's Printed Name

Date

Title

Signature

Section 10. Attachments

10.1. Project Detailed Cost Estimates

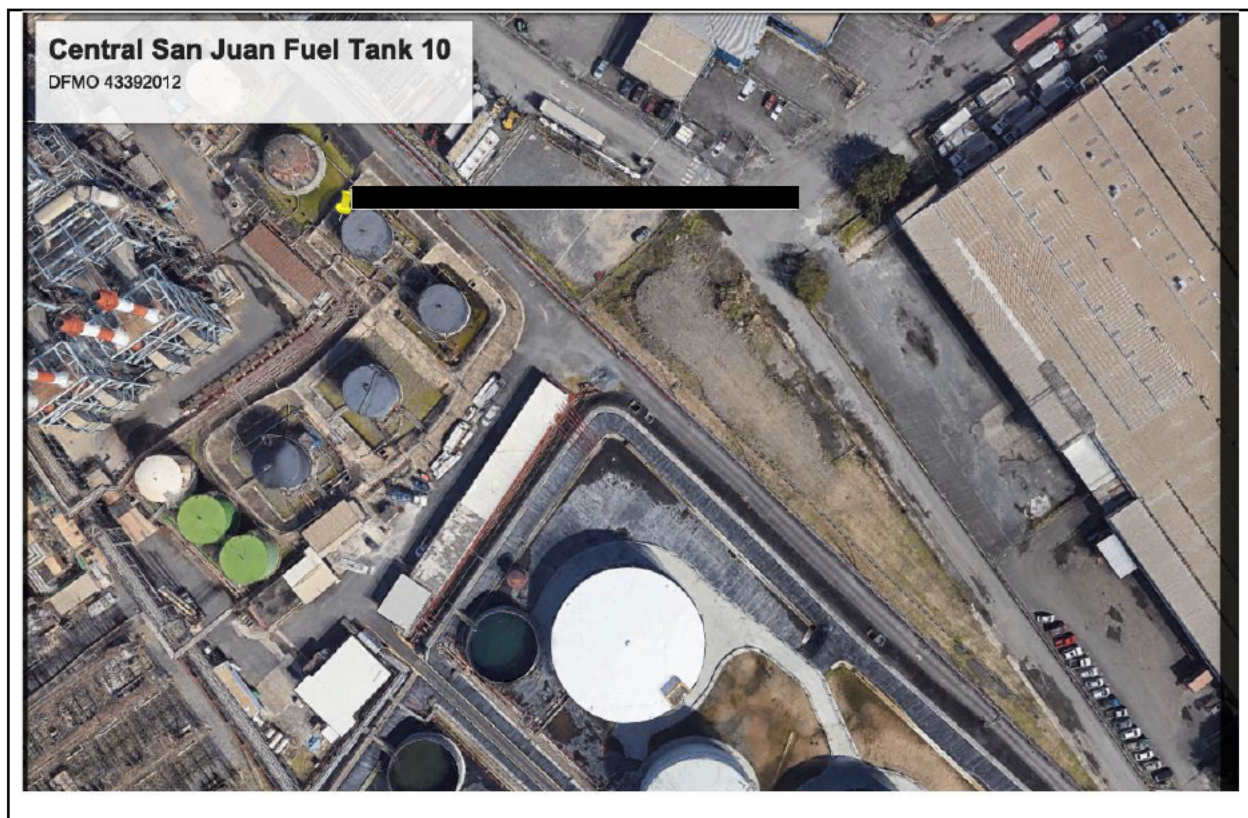
Please see attached the following:

- 15010 – Special Conditions rev S-10 SJSP
- RFP 0002682_Tank S-10
- Technical Evaluation Memo_RFP 0002682

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures





10.4. Other: (Please Describe)

N/A



GOBIERNO DE PUERTO RICO
Autoridad de Energía Eléctrica de Puerto Rico

31 de agosto de 2020

John Uphoff Figueroa, Presidente
Comité Permanente de Subastas

Jaime A. Umpierre Montalvo, Jefe
División de Ingeniería y Servicios Técnicos

Evaluación Técnica Subasta RFP 0002682, Requisición 224321, Reparación y Conservación Tanque Servicio Combustible S-10, Central San Juan, proyecto TSV-04-18

La subasta del asunto se realizó el 18 de agosto de 2020. El alcance de los trabajos incluye la rehabilitación general y recubrimiento anticorrosivo exterior e interior al tanque para combustible de servicio S-10 en la Central San Juan. El costo estimado es de \$560,000. Los fondos están asignados en el Programa de Gastos de Mantenimiento Necesarios (GMN) para los años fiscales 2020-2021.

En el proceso de subasta participaron dos licitadores que presentaron las siguientes propuestas:

LICITADOR	CANTIDAD	EXCEPCIONES
Alonso & Carus Iron Works (A&C)	\$695,013	Ninguna
Energys Engineering Corporation (EEC)	\$647,000	Ninguna

Luego de evaluar cada oferta incluimos nuestros comentarios, conclusiones y recomendación. Ambos licitadores cumplen con los requisitos técnicos de la subasta.

La propuesta de Alonso y Carus incluyó todos los documentos solicitados en las especificaciones técnicas por lo que es considerada respondiente. Sin embargo, la cantidad cotizada excede considerablemente la cantidad estimada y la consideramos onerosa.

La propuesta de Energys Engineering incluyó todos los documentos solicitados en las especificaciones técnicas por lo que es considerada respondiente. La cantidad cotizada está dentro del 20% del costo estimado.



Conclusiones y Recomendaciones

Es necesario reparar este tanque y retornarlo a servicio lo antes posible. Este está vacío y lleva expuesto al ambiente por largo tiempo, lo que promueve que se deteriore por corrosión. Además, el tanque de servicio S-9 tiene perforaciones en el techo lo que limita el acceso para realizar tareas de operación y mantenimiento. Es importante señalar que la condición de este último causó un derrame de combustible por sobrellenado durante una transferencia.

Luego de la evaluación de ambas propuestas, Enersys incluyó todos los documentos solicitados en las especificaciones técnicas por lo que se considera técnicamente respondiente y el precio de la propuesta está dentro del 20% (16%) del estimado de la Autoridad por lo cual recomendamos la misma favorablemente.

De requerir información adicional, favor de comunicarse por el 6541.

Coordinado

Gerardo Sánchez Pierluisi, Gerente
Oficina de Presupuesto
Directorado de Generación

Aprobado

Daniel Hernández Morales
Director de Generación

C Fernando M. Padilla Padilla



Puerto Rico Electric Power Authority
Executive Directorate
Engineering and Technical Services Division

San Juan Steam Plant
Fuel Oil #6 Service Tank S-10 Rehabilitation
RFP 0002682

San Juan, P. R.
June 2020

San Juan Steam Plant
Fuel Oil #6 Service Tank S-10 Rehabilitation
RFP 0002682

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Scope of Work Description

The Contractor shall furnish and provide all engineering, design, labor, equipment, materials and supervision required to successfully rehabilitate the San Juan Steam Plant Fuel Oil #6 Service Tank S-10 including but not limited to repair of welds undercuts, bottom plates, replacement of some stairs steps and support bars, repair of landing platform, replacement of some roof nozzles and flanges. The illumination system shall be replaced and a new tank level measuring system will be install. A complete internal and external coating system shall be applied. The internal system shall be based on a flake reinforced 100% solids amine cured epoxy. The external shall be based on a three coat system consisting of: (1) a metallic zinc rich epoxy primer, (2) two component low VOC high build self-priming, surface tolerant, lamellar aluminum flakes reinforced, epoxy mastic and finished with (3) a two component, high solids, low VOC, abrasion resistance, high gloss epoxy siloxane.

All work as described above shall be completed in one hundred eighty (180) days starting after the issuance of the Notice to Proceed (NTP). A daily penalty of one thousand two hundred dollars (\$1,200) shall be applicable for each day of delay after the one hundred eighty (180) days of the completion of the Work term, up to a maximum of 15% of the contract value.

PROPOSAL
SECTION I

_____, 20__

Puerto Rico Electric Power Authority San Juan, Puerto Rico

In compliance with your INVITATION TO BID for the *San Juan Steam Plant Fuel Oil #6 Service Tank S-10 Rehabilitation* and having carefully examined and completely understood all of the Contractor's documents, the undersigned proposes to furnish all labor, equipment, and materials not provided by PREPA or Others, and to perform all work as detailed, indicated or described in said Contractor's documents, and subject to all conditions stipulated therein, starting at the date of receipt of the Order to Proceed and finishing in _____() calendar days.

(in words)

for the LUMP SUM of _____() dollars.

(in words)

BIDDER

PROPOSAL
SECTION I-A

_____, 20__

Contract Sum Breakdown (the sum of all breakdown items shall equal the proposed Contract Lump Sum shown on Page 1 of the proposal):

- | | | |
|-----|---|----------|
| 1. | Mobilization (Includes Taxes, Insurance & Permits) | \$ _____ |
| 2. | Anchor Design Calculation | \$ _____ |
| 3. | Repairs Based on Inspection Report | \$ _____ |
| 4. | Stairway Repairs (Including Top Platform) | \$ _____ |
| 5. | Roof Nozzles Flanges Replacement (4) | \$ _____ |
| 6. | Tank Level Equipment (Varec 2920 FTT & 6700) | \$ _____ |
| 7. | Roof or Shell Insert Plates (10 ft ²) | \$ _____ |
| 8. | Bottom Lap Patches (10 ft ²) | \$ _____ |
| 9. | Weld Repairs Shell to Bottom or Any Butt Welds (10 ft) | \$ _____ |
| 10. | Weld Repairs Bottom or Any Fillet Weld (10 ft) | \$ _____ |
| 11. | Tank Encapsulation (Include Here All Scaffolds) | \$ _____ |
| 12. | Interior Coating Material | \$ _____ |
| 13. | Interior Coating Labor (Include Here Surface Preparation) | \$ _____ |
| 14. | Exterior Coating Material | \$ _____ |
| 15. | Exterior Coating Labor (Include Here Surface Preparation) | \$ _____ |
| 16. | Non Destructive Testing (Include Here Coating Inspection) | \$ _____ |
| 17. | Hydro Testing | \$ _____ |
| | Contract Sum | \$ _____ |

I-A.1 The following fees will apply to changes in the work:

1. 15% overhead and profit on the net cost of work done by the Contractor.
2. 10% overhead and profit on the gross cost (net plus fee) of work done by subcontractor.
3. On work deleted from the Purchase Order/Contract, credit to the Owner shall be the Engineer net cost.
4. When both additions and credits covering related work or substitutions are involved in any one change, the allowance for overhead and profit shall be figured out on the basis of the net increase, if any, with respect to that change.

BIDDER

SECTION II
QUALIFICATIONS OF BIDDERS

1. We hereby submit the following data regarding our qualifications:

A. Permanent Place of Business

- a) Street _____ No. _____
- b) _____ City _____
- c) Zip Code _____ Telephone Number _____
- d) Cellular _____ Electronic Mail _____

B. Financial Statement

- a) Cash in bank or on hand \$ _____
- b) Total property value \$ _____
- c) Other assets total value \$ _____
- Total \$ _____
- d) Liabilities \$ _____
- Net \$ _____

BIDDER

QUALIFICATIONS OF BIDDERS (continued)

2. The following is a list of equipment I or we have available for use on this work:

<i>ITEM NO.</i>	<i>QTY.</i>	<i>DESCRIPTION, SIZE CAPACITY, ETC.</i>	<i>CONDITION</i>	<i>YEARS OF SERVICES</i>	<i>PRESENT LOCATION</i>

BIDDER

QUALIFICATIONS OF BIDDERS (continued)

3. The following is a list of additional equipment I or we intend to purchase or rent for use on the proposed work, should the contract be awarded to me or us:

<i>ITEM NO.</i>	<i>QTY.</i>	<i>DESCRITPION, SIZE, CAPACITY, ETC.</i>	<i>APPROX. COST</i>	<i>DATE OF DELIVERY</i>

BIDDER

QUALIFICATIONS OF BIDDERS (continued)

4. The following is a list of similar contracts executed by me or us:

ITEM NO.	QTY.	TYPE OF WORK	CONTRACT PRICE	COMPLETION DATE

BIDDER

QUALIFICATIONS OF BIDDERS (continued)

5. The following is a list of contracts on hand:

CONTRACT NUMBER	DESCRIPTION OF WORK	CONTRACT PRICE	% COMPLETED

BIDDER

6. Type of Organization and Business

[illegible]

BIDDER

8. Construction Methods to be Used in the Work (Bidder to outline the principal methods and order of procedure to be employed in the work)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

BIDDER

This Proposal complies with the Puerto Rico Electric Power Authority's Specifications 31205 (including all supporting documents named therein) which are hereby made a part thereof, and which shall govern in case of conflict with any other provision of this Proposal, except as stated immediately below, in **EXCEPTIONS** numbered _____ to _____ inclusive.

(Use additional sheets if necessary and attach to back of this page)

BIDDER

SECTION IV
ADDENDUM RECEIPT

The undersigned certifies that the following addenda to the Specifications have been received and are made a part of the contract documents:

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

BIDDER

PROPOSAL (continued)

The undersigned, _____
(Print Name of Undersigned)

on behalf of _____
(Company Name)

submits the Proposal hereinbefore contained.

Dated _____

This _____ day of _____, 20 ____.

(Name of Organization)

By: _____
(Signature of Person Signing for
the Organization)

Official Title of Person Signing

Official Address of Organization

Social Security Organization

BIDDER

Puerto Rico Electric Power Authority
Executive Directorate
Engineering and Technical Services Division

Puerto Rico Electric Power Authority
Executive Directorate

San Juan Steam Plant
Fuel Oil #6 Service Tank S-10 Rehabilitation
RFP 0002682

San Juan, PR
June, 2020

PUERTO RICO ELECTRIC POWER AUTHORITY
EXECUTIVE DIRECTORATE

RFP 002682

SAN JUA STEAM PLANT
FUEL OIL #6 SERVICE TANK S-10 REHABILITATION

APPEAR

AS FIRST PARTY: The Puerto Rico Electric Power Authority (PREPA), a public corporation and government instrumentality of the Government of Puerto Rico, created by Act of May 2, 1941, No. 83, as amended, represented in this act by its Chief Executive Officer/Executive Director, José F. Ortiz Vázquez, of legal age, married and resident of San Juan, Puerto Rico.

AS SECOND PARTY: [contractor's name] (Contractor), a [partnership or corporation] organized and existing under the laws of [State], authorized to do business in Puerto Rico, represented in this act by its [title], [name], of [legal status], and resident of [domicile], by virtue of [document that certifies representative powers] dated as [effective document date].

WITNESSETH

WHEREAS, PREPA, by virtue of its enabling act, Act 83 of May 2, 1941, as amended (Act 83), has the authority to engage those professional, technical and consulting services necessary and convenient to the activities, programs, and operations of PREPA;-----

WHEREAS, as established in Section 205 (1) of Act 83, all purchases and contracts for supplies or services, except personal services, made by PREPA, including its capital construction contracts, shall be made by calling for bids with sufficient time before the date the bids are opened so that PREPA can guarantee proper knowledge and appearance of competitive bidders; -----

WHEREAS, this Contract was awarded to the Contractor on [INSERT DATE] by means of a bid process [INSERT BID PROCESS NUMBER]. -----

THEREFORE, in consideration of the mutual covenants hereinafter stated, the Parties hereby agree to execute the Contract as follows: -----

ARTICLE 1. Scope of Contract

The Contractor shall furnish all labor, materials, equipment, tools, supervision, test and permits for the San Juan Power Plant Service Tank S-10 Rehabilitation in strict accordance with the provisions of this Contract, including the General Conditions, Special Conditions, Proposal Forms, Contractor's Bidding Proposal, and reference drawings, all of which are hereby made a part hereof (Services). Provided that, on or before the term of this Contract is expired the Contractor shall deliver to PREPA a true and exact copy of all diagrams, plans, sketches, maps, and other documents used in the performance of Services and for which a third party copyright or patent right would not be an impediment for such delivery. -----

ARTICLE 2. Definitions

Whenever the words defined in this article or pronouns used instead they shall have the meanings here given: -----

2.1 Act of God – is construed herein to mean an earthquake, hurricane or other cataclysmic phenomenon of nature not ordinarily occurring. Rains, windstorms, floods or other natural phenomenon of normal intensity for the particular locality as determined by the preceding five (5) year monthly average from records of the nearest National Oceanic and Atmospheric Administration recording station shall not be construed as an Act of God. -----

2.2 Applicable Law – shall mean any federal, state or local act, statute, law, code, rule, regulation or order applicable to Contractor's performance of the work.-----

2.3 Calendar Day – shall mean every 24-hour day shown on the calendar, beginning and ending at midnight. -----

2.4 Completion Date – date in which all tasks and project scope had completed.-----

2.5 Contracting Officer- shall mean PREPA's Chief Executive Officer, acting directly or through his properly authorized agents.-----

2.6 "Contract"- shall mean, collectively, all the covenants, terms, and stipulations in these articles of agreement and in all supplementary documents hereto attached which constitute essential parts of the Contract and are hereby made part thereof, to wit:-----

- a. Contract
- b. Invitation to Bid and Advertisement for Bids
- c. Instruction to Bidders

- d. Special Conditions and Drawings
- e. Technical Specifications
- f. Proposal Forms
- g. Performance and Payment Bonds
- h. Letter of Award
- i. Contractor's Bid Proposal dated [INSERT DATE] including Bid Data and Schedules

Except as otherwise provided in this Contract, if any provision contained in Contractor's Proposal dated [INSERT DATE] is in conflict with the terms and conditions of the Contract, the terms and conditions of the Contract shall prevail.-----

2.7 Construction Manager - shall mean the professional assigned by the Contractor to provide the construction management services on the project. This professional shall be a professional engineer registered in Puerto Rico and an active member of the Puerto Rico College of Engineers and Land Surveyors.-----

2.8 Change Order - A written agreement between the parties that sets out changes in price, time, or Scope of Contract.-----

2.9 Critical Path Method (CPM) – A scheduling technique used to plan and control a project that combines all relevant information into a single plan defining the sequence and duration of operations, and depict the interrelationship of the work elements to complete the project. The critical path is define as the longest sequence of activities in a network, which establishes the minimum length of the time for accomplishment, the last event of the project.-----

2.10 Delay - Event that extends (affect) the completion date of the project, by affecting tasks on the critical path. The project schedule shall clearly display that the Contractor has used, in full, all the float time available for the work involve with this request. -----

2.11 Disruption - The effect of events upon a non-critical path that, while using additional recourses and extending the duration of that particular activity, or path of activities, does not extend the end date of the project.-----

2.12 Engineer - shall mean the PREPA's Director of Generation, acting directly or through his properly authorized representatives. -----

2.13 Final Acceptance – shall mean the written approval by PREPA that Services are completed, the final cleaning up of the site has performed, and all Punch List items have rectified.-----

2.14 Force Account Work - Extra work in which the Contractor delegate the administration to PREPA and that is paid for on the basis of actual costs for labor, materials, equipment, bonds, insurance, and taxes, plus an established allowance, as provided in this Contract or Special Conditions.-----

2.15 Letter of Award (LOA) – Letter signed by the Director of the Generation, to notify the bidder that the bid is being awarded to him and to require documents prior to contract signing, such as but not limited to; Corporate Resolution, evidence of payment and certificate of the Puerto Rico State Insurance Fund, municipal taxes, Construction excise taxes, certificate of insurances and endorsements, payment and performance bonds. The Contractor shall, not later than ten (10) working days, after receipt of the Letter of Award (LOA), furnish all documents required therein. -----

2.16 Letter of Release – Letter signed by the Contractor's contracting officer and notarized stating that the Contractor has no debt with, but no limited to, subcontractors, consultants, material and services supplier, Federal and State Agencies, Municipality, manufacturer or insurance agency. -----

2.17 Notice to Proceed – a written order sent to the Contractor by the Contracting Officer, or his designated representative, notifying the Contractor of the date upon which the Contractor is given authority to begin the work. -----

2.18 Owner – designates the Puerto Rico Electric Power Authority (PREPA). -----

2.19 Punch List - shall mean the list of non-conforming or incomplete work items identified by PREPA for the Final Acceptance of Services.-----

2.20 Resident Engineer - shall mean the manager of the field office responsible for, but not limited to, the administrative issues, quality control, and technical aspects of the project. This person shall be a professional engineer register in Puerto Rico and an active member of the Puerto Rico College of Engineers and Land Surveyors. The Resident Engineer shall be present on site at all times in order to the Contractor be able to perform any task of the project. -----

2.21 Safety Officer – shall be the person designated by the Contractor whose duty shall be the prevention of accidents and implement, both, the Safety and Health Program and the Site Specific Work Plan. The Safety Officer may be the Contractor's project superintendent or supervisor and shall comply with occupational safety and health requirements for the construction industry. The Safety Officer shall be present at all times on site in order to the Contractor be able to perform any task of the project.-----

2.22 Special Conditions – are all special requirements, regulations and/or directions covering conditions peculiar to a particular project.-----

2.23 Substantial Completion - shall mean the date certified by PREPA, that the Contractor shall reached the stage of completion when PREPA accepts the legal and safe use of the facility or system for its intended purposes, even though all work is not completed. At the stage, the time of completion of the entire work shall cease and the accruing of penalties. -----

However, the Contractor shall finish all items included in the Punch List before Final Acceptance of Services, including the following:-----

- A. The Service Tank S-10 is back online and with 100% availability.
- B. All coating systems (internal and external) have been installed, tested and fully cured in compliance with the specifications.-----
- C. All tank level indication equipment have been installed, tested and in service as per the specifications
- D. Contractor had submitted all certifications of compliance of field and laboratory tests.-----
- E. Contractor had submitted all debris and excess soil disposal manifests.-----
- F. All required equipment had installed and tested by Contractor.-----
- G. Site is clean.-----

2.24 Subcontractor – shall mean any supplier, or vendor of the Contractor engaged for the purposes of progressing the work under a subcontract with the Contractor and in which the Contractor has no equity interest or profit-sharing affiliation. Any such entity in which the Contractor owns equity or has a profit-sharing affiliation shall be considered to be the Contractor. Contractor shall comply with requirements set forth on ARTICLE 26 – Subcontractors. -----

2.25 Working Day – shall mean each day Monday thru Friday and hours from 7:00 AM to 11:30 AM and from 12:30 PM to 4:00 PM. -----

ARTICLE 3. Consideration

The total amount to be paid under this Contract shall not exceed [INSERT AMOUNT] (\$_____) (the Contract Amount). However, nothing herein shall preclude the Parties from agreeing to increase the Contract Amount by written amendment signed by both Parties. -----

The Contractor shall submit its invoices for work already done according to the payment schedule approved by the Engineer together with the technical supporting documents of required tests. All invoices shall be subject to the Engineer's approval before paid and shall include the actualized progress schedule, S-curve graph and all other documents

required in the Special Conditions. All invoices shall be subject to PREPA's approval before being paid, and its payment shall be done within sixty (60) days after the date of its approval. PREPA shall retain ten percent (10%) of each payment until completion and acceptance of all Services. -----

After Final Acceptance, PREPA will pay to Contractor all retained percentages less the corresponding deductions. The Contractor shall submit a Letter of Release ("Carta de Relevó"), WHICH SHALL BE NOTARIZED and in which the Contractor shall state that there is not debt with any sub-contractor, manufacturer, employee, government agency, municipality and service or materials provider. -----

Invoices must also include a written and signed certification stating that no officer or employee of PREPA, and their respective subsidiaries or affiliates, will personally derive or obtain any benefit or profit of any kind from this Contract, with the acknowledgment that invoices that do not include this certification will not be paid. This certification must read as follows:-----

We certify under penalty of absolute nullity that no public servant of PREPA is a party or has any interest in the benefit or profit product of the Contract, which is the basis of this invoice. If such benefit or profit exists, the required waiver has been obtained prior to entering into the Contract. The only consideration to be received in exchange for the delivery of Services provided is the agreed-upon price that has been negotiated with an authorized representative of PREPA. The total amount shown on this invoice is true and correct. The Services have been rendered, and no payment has been received.

Contractor's Signature

All professionals admitted to practice a profession in Puerto Rico, who will provide services through this Contract; must provide prior to the execution of the Contract evidence of said license issued by the corresponding regulatory entity. -----

ARTICLE 4. Commencement and Completion of Work

4.1 General

The Contractor shall be required to complete all task and project scope within one hundred eighty (180) calendar days from the date of the Notice to Proceed, subject to the provisions stated in Article 8, Changes and/or Extra Work,

Article 13, Force Majeure; Article 17, Termination for Convenience; and Article 18 Termination for Cause. The Contractor shall receive a written order, stating the date on which the Contractor shall commence to execute the contracted work. Thus, Notice to Proceed date marks the beginning of commencement of work. Mobilization shall be completed within ten (10) days after the Notice to Proceed. Both Parties agree that time is the essence of the Contract.-----

The demand of the obligations of either party under this Contract will be subject to the filing of the Contract at the Office of the Comptroller of the Commonwealth of Puerto Rico, in compliance with Act of October 30, 1975, No. 18, as amended.-----

The Contractor shall, not later than ten (10) working days, after receipt of the Letter of Award (LOA) signed by the Engineer, furnish all documents required therein.-----

4.2 Schedule of Proposed Progress

The Contractor, within fifteen (15) days after receipt of the Notice to Proceed shall file with the Engineer a schedule of proposed progress and the proposed detailed method of carrying on the Services including a full statement of equipment and equipment layout for the job. This progress chart and statement of operations shall show the dates of commencement and completion of each item of the Services. This schedule shall also include the milestones for the submittals and material ordering, the critical path of the project, and the man-hours per item. The Contractor shall provide for the use of adequate and sufficient equipment and force and a method of operations to assure the completion of the work within allotted time. The schedule shall be monthly actualized and submitted to PREPA for approval. All requirements on the attached Special Conditions shall also apply.-----

4.3 S-curve Graph

The Contractor shall file the S-curve Graph within fifteen (15) days after receipt of the Notice to Proceed. The S-curve shall plotted with the percent of work completed in the Y-axis and the cost in the X-axis. This graph shall be based on the proposed schedule define on Section 4.2 above.-----

4.4 Payment Schedule

The Contractor within fifteen (15) days after receipt of the Letter of Award. The Schedule of Payment shall be balanced throughout the whole project and if

said schedule is not satisfactory to the Engineer, it shall be revised by the Contractor and resubmitted for its approval.-----

4.5 Contract Quantity Report

The Contractor shall submit weekly and for approval, to the Engineer, the Contract Quantity Report sheet. The Contractor at the preconstruction meeting will give the format for this sheet.-----

ARTICLE 5. Suspension of Work

The Contracting Officer may, at any time, suspend the whole or any portion of the Services under this Contract, but this right shall not be construed as denying the Contractor actual reasonable and necessary expenses due to delays, caused by such suspension. These expenses shall not be allowed when ordered by the Contracting Officer because of a Force Majeure Event, as defined in Article 13, Force Majeure. The cause of such suspension shall be put in writing by the Contracting Officer within two (2) working days after the suspension or as soon as practicable.-----

ARTICLE 6. Other Work at the Site

PREPA reserves the right to perform other work by force account and/or enter into other contracts in connection with the Services. The Contractor shall afford PREPA and other contractor reasonable opportunity for the introduction and storage of materials and the execution of the work and shall properly connect and coordinate his work with theirs. The Contractor shall inspect and promptly report to PREPA any defects in such work or any conflicts between such work and that of the Contractor.-----

ARTICLE 7. Submittals

The Engineer shall evaluate submittals within fifteen (15) working days to mark them as disapproved; approved as corrected or approved it becomes necessary. The Contractor is responsible to submit three (3) sets of the submittals. All disapproved submittals shall be corrected as required and resubmitted for PREPA's evaluation. In case of discrepancy in the submittals, including Contractor's disagreement with corrections requested by the Engineer or PREPA, the matter shall be submitted to the Engineer, and the Contractor shall not proceed with the work so affected until the Parties resolve such discrepancy in good faith. -----

Review or approval of Contractor's submittals shall in no way relieve the Contractor from its responsibilities, obligations or liabilities under this Contract. The Contractor shall obtain such reviews or approval in writing from PREPA. The Contractor shall keep at the site one hard copy of the Contract documents,

specifications and drawings, and shall give the Engineer access thereto. Anything called for in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications shall be of like effect as if called for or shown on both. All construction work called for in the specifications and/or shown on the drawings to be performed by the Contractor shall be performed in strict accordance with the technical requirements of the Specifications.-----

Before commencement of Services, the Contractor shall submit for PREPA's approval the Occupational Safety and Health Program required in Article 44. Safety Provisions.--

ARTICLE 8. Changes and/or Extra Work

PREPA may, at any time, make changes or order extra work within the Scope of Work subject to previous written approval of the Contracting Officer. Changes requested by PREPA may include, but not limited to, changes: -----

1. In the specifications including drawings and design.
2. In the method or manner of performance of the Services.
3. In PREPA's furnished facilities, equipment, materials, services, or site; and/or,
4. Acceleration in the performance of the Services.

Within ten (10) working days after receipt of PREPA's written order of a change in the work (or such shorter or longer period of time as may be reasonably required as agree by PREPA and the Contractor), Contractor shall promptly notify PREPA of the cost, schedule and other impact(s) Contractor anticipate as a result of the change. If PREPA agrees with the Contractor's statement as to the impact of the change, the Parties shall proceed promptly to enter into a written change order in connection with such change to equitably adjust Contractor's cost (increase or decrease), schedule (lengthen or shorten), or other obligations under Contract in connection with such change. PREPA shall promptly notify Contractor in writing of the basis for any disagreement and PREPA and Contractor shall negotiate in good faith to resolve any issues in order to, when applicable, enter into a written change order to equitably adjust Contractor's cost (increase or decrease), schedule (lengthen or shorten), or other obligations under the Contract in connection with such change. Acceptance of the change order and an adjustment in the Contract Amount and/or Contract time shall not be unreasonable withheld. -----

If agreement on the prices for the extra work cannot be reached between PREPA and the Contractor, PREPA may order in writing the Contractor to perform the required work on a force account basis. Payment for such Force Account work shall be as specified in Article 1.10 - Force Account, of the Special Conditions. PREPA may also elect to have such work performed by its own forces or by separate contract. -----

In order to facilitate review of quotations for extras or credits, all proposals submitted by Contractor in connection with a change in the work by PREPA, except those so minor that their propriety can be seen by inspections, shall be accomplished by a complete itemization of the costs including labor, materials, equipment and subcontracts. When subcontractors perform major cost items, they shall itemized it. -----

ARTICLE 9. Inspection

9.1.1 Periodic Inspection

All material and workmanship (if not otherwise designated by the specifications) shall be subject to inspection, examination, and test by PREPA's inspectors, at all reasonable times. PREPA shall have the right to reject defective material, equipment or workmanship or require its correction. Rejected workmanship shall be satisfactorily corrected and rejected material and equipment furnished by the Contractor shall be satisfactorily replaced with proper material and equipment, without charge to PREPA. The Contractor shall promptly remove rejected material from the premises. The Contractor shall furnish promptly all reasonable facilities, labor, materials, and equipment necessary for the safe and convenient inspection and tests that may be performed in such manners as not to unnecessarily delay the work.-----

9.1.2 Final Inspection

Whenever all the materials have been furnished and all work has been performed, including final cleaning up as contemplated in ARTICLE 45. Cleaning Up, all in accordance with the drawings and specifications, the Contractor shall notify in writing the Engineer that said work is completed and ready for final inspection. Final inspection shall occur within a ten (10) working days period after the Engineer has received notice from the Contractor of the satisfactory completion of the installation of the equipment.----

After receipt of notice, PREPA will notify Contractor of the exact date and time of the final inspection and Contractor shall accommodate PREPA's specific time. If all installation work provided for and contemplated by the Contract is found completed in accordance with the specifications, this inspection shall constitute the final inspection and the Completion Date shall be established as the date of receipt of the notice of the Contractor that the work was completed and ready for final inspection. If, however, upon inspection by the Engineer it is found that any work, in whole or in part, is unsatisfactory, the Engineer shall give the Contractor the necessary instructions as to replacement of material and performance of work necessary to final completion and acceptance and the Contractor shall immediately comply with and execute such instructions. Upon satisfactory replacement and performance of such work, the Contractor shall notify the Engineer, and another inspection shall be made which will constitute the final inspection if the said material is found to have been acceptably

replaced and the work completed satisfactorily. In such event, the date of receipt of this last notice of the Contractor will be established as the Completion Date of the work or any separable part thereof under the Contract. The Completion Date, thus established, shall be used in calculating the actual time of performance of the work. -----

The determination of whether a project is substantially completed is at the discretion of PREPA. This project shall be considered substantially completed as established in the when PREPA accepts the legal and safe use of the facility or system for its intended purposes, even though not all work is completed. At the stage, the time of completion of the entire work shall cease and the accruing of penalties. However, the Contractor shall finish all items included in the Punch List before Final Acceptance of Services, including items listed in Article 2.15, Substantial Completion.-----

ARTICLE 10. Superintendence by the Contractor

Before commencement of the work, the Contractor shall designate a competent construction manager, satisfactory to the Engineer, with the expertise and resources necessary to provide construction management services. The Contractor shall also designate a competent resident engineer, satisfactory to the Engineer, on the work site, at all times, during progress of the work, with authority to act for him. The construction manager and resident engineer shall represent the Contractor on his absence and all directions given to him by the Engineer shall be as binding as if given to the Contractor. The Contractor shall, at all times, enforce strict discipline and good order among his employees and shall not employ on the work any unsuitable or unskilled person in the work assigned to him. In addition, the Contractor shall be fully responsible for the negligent or wrongful acts or omissions of subcontractors or of persons both directly or indirectly employed by the Contractor, and shall be liable to PREPA and/or any affected third parties for such acts or omissions.-----

ARTICLE 11. Sanitary Facilities

The Contractor shall furnish and maintain satisfactory, sanitary facilities for the use of the workers engaged in the construction, as required by law or regulations. -----

ARTICLE 12. Access to Work

The Contractor shall permit all persons appointed or authorized by PREPA to visit and inspect the work, or any part thereof at all times, and places during the progress of it. ---

ARTICLE 13. Force Majeure

The Parties hereto shall be excused from performing hereunder and shall not be liable in damages or otherwise, if and only to the extent that they shall be unable to perform, or are prevented from performing by a force majeure event. For purposes of this

Contract, force majeure means any cause without the fault or negligence, and beyond the reasonable control of, the party claiming the occurrence of a force majeure event. Force majeure may include, but not be limited to, the following: Acts of God, industrial disturbances, acts of the public, enemy, war, blockages, boycotts, riots, insurrections, epidemics, earthquakes, storms, floods, civil disturbances, lockouts, fires, explosions, interruptions of services due to the acts or failure to act of any governmental authority, provided that these events, or any other claimed as a force majeure event, and/or its effects, are beyond the reasonable control and without the fault or negligence of the party claiming the force majeure, and that such party, within ten (10) days after the occurrence of the alleged force majeure, gives the other party written notice describing the particulars of the occurrence and its estimated duration. The burden of proof as to whether a force majeure has occurred shall be on the party claiming the force majeure.-

ARTICLE 14. Penalty for Delays

If the Contractor fails to complete the work, or any separable part thereof, within the time established in the Article 4, Commencement and Completion of Work, the Contractor shall pay to PREPA a penalty of one thousand two hundred dollars (\$1,200) for each calendar day of delay in completing the Services, up to a maximum of fifteen percent (15%) of the Contract Amount, and the Contractor and his sureties shall be joint and several liable for said amount. In the event that the Contractor, due to his delay, had pay the total amount of the penalty, and has failed to complete the Services or any part separable thereof, it could be considered a breach of the Contract, and PREPA may terminate the Contract, execute the performance bond and pursue any other remedies under this Contract, law or equity.-----

In case of delay, the Contractor shall within ten (10) days from the beginning of any such delay notify the Head, Engineering and Technical Services Division in writing of the causes of delay, who shall ascertain the facts and the extent of the delay and extend the time for completing the Services when, in his judgment, the findings of facts justify such an extension, and his findings of facts thereon shall be final and conclusive on the parties hereto, subject only to appeal by the Contractor as provided in Article 29, Disputes, hereof; provided that, no claim shall be made by the Contractor against PREPA, its agents, contractors, subcontractors, employees, successors, assignees, for any cause whatsoever, during the progress of any portion of the Services embraced in the Contract. Any damages caused by delays or hindrances exclusively by PREPA shall be considered as fully compensated for by the extensions of time as provided above.-----

If PREPA does not terminate the right of the Contractor to proceed, the Contractor shall continue the Services in which event shall pay to PREPA a penalty in the amount set forth above for each calendar day of delay until the Services are completed, and the Contractor and his sureties shall be liable for the amount thereof; provided that, the right

of the Contractor to proceed shall not be terminated or the Contractor charged with a penalty because of any delays in the completion of the Services due to force majeure events or situations, or failures on the part of PREPA to carry out its obligations.-----

PREPA shall have the right to the payment or to the withholding of Contractor's payments in case of Contractor's delay in completion of the Services. The Contractor agrees that the penalty shall not be subject to reduction, moderation or modification, since this penalty is a pecuniary punishment for the delay, and not a liquidation of damages.-----

ARTICLE 15. Liabilities

15.1 Civil Responsibility

The appearing parties agree that the Puerto Rico Civil Code and its case law, as dictated by the Supreme Court of Puerto Rico will govern their responsibilities for damages under this Contract.-----

15.2 Protection Against the Occurrence of Damages

The Contractor agrees to make, use, provide, and take all proper, reasonably necessary and sufficient precautions, safeguards, and protection against the occurrence or happenings of injuries, death and/or damages to any person or property during the progress of the work.-----

15.3 Save and Harmless

The Contractor agrees to indemnify and save harmless PREPA for all expenses and costs of any nature (including attorneys' fees) incurred by PREPA arising out of any claim made by any person for personal injuries, including death, sustained by any person, including the employees of Contractor, and for damage to third party property to the extent such injuries, death or third party damages are caused by the fault, negligent acts or omission of Contractor, its employees, subcontractors or affiliated companies, arising out of its or their performance and/or failure to perform the Services. -----

15.4 Save Harmless for Operation of PREPA's Equipment

The operation of PREPA's equipment by PREPA at its plant site is within the exclusive control of PREPA. PREPA shall indemnify and save harmless the Contractor from loss, expense or liability imposed upon the Contractor for any injury to a person, including death resulting therefrom or damage to any property resulting from the operation of such equipment by PREPA.-----

If the Contractor is allowed to operate PREPA's equipment at the plant site, the Contractor shall indemnify and save harmless PREPA from loss, expense or liability imposed upon PREPA for any injury to a person, including death resulting there from or damage to any property resulting from the operation of such equipment by the Contractor.-----

15.5 Contractor's Liability

The overall aggregate liability of Contractor with respect to any and all claims arising out of the performance or non-performance of obligations under the Contract, regardless of any legal theory or cause of action under which such liability may arise, shall not exceed the Contract Price (which includes authorized changes, if any). However, the foregoing dollar limitation shall not apply to liability arising from third party claims for bodily injury or third party property damage to the extent such liability results from Contractor's fault or negligent acts or omissions while working under the Contract. -----

ARTICLE 16. Independent Contractor

The Contractor shall be considered as an independent contractor, for all material purposes under this Contract, and all persons engaged or contracted by the Contractor for the performance of its obligations herein, shall be considered as its employees or agents or those of its subcontractors, and not as employees or agents of PREPA. In consequence, the Contractor is not entitled to any fringe benefits, such as, but not limited to vacations, sick leave, and other.-----

ARTICLE 17. Termination for Convenience

PREPA shall have the right to terminate this Contract for convenience, at any moment, by providing the other party thirty (30) days written notice by registered mail, return receipt requested, or overnight express mail. If notice is given, this Contract shall terminate upon the expiration of thirty (30) days and PREPA shall be obligated to pay all fees and expenses incurred up to the day of effective termination, in accordance with the terms of this Contract. The rights, duties and responsibilities of the Parties shall continue in full force and effect during the thirty (30) day notice period. Contractor shall have no further right to compensation except for what has been accrued for services rendered under this Contract until said date of effective termination.-----

ARTICLE 18. Termination for Cause

PREPA shall have the right to terminate this Contract immediately in the event of negligence, dereliction of duty, noncompliance, or material breach by the Contractor, as

determined in the sole discretion of PREPA, or for any other reason described elsewhere in this Contract as a basis for termination. In the event the Contract is terminated by PREPA for cause, PREPA shall be obligated to pay all fees and expenses incurred up to the day of effective termination, in accordance with the terms of this Contract. Contractor shall have no further right to compensation except for what has been accrued for services rendered under this Contract until said date of effective termination.-----

ARTICLE 19. Insurance, Bonds, and Indemnities

The Contractor shall secure and maintain in full force and effect during the life of this Contract as provided herein, policies of insurance covering all operations engaged in by the Agreement:-----

19.1. Commonwealth of Puerto Rico Workmen's Compensation Insurance:

The Contractor shall provide Workmen's Compensation Insurance as required by the Workmen's Compensation Act 45-1935 of the Commonwealth of Puerto Rico. The Contractor shall also be responsible for compliance with said Workmen's Compensation Act by all its subcontractors, agents, and invitees, if any.-----

The Contractor shall furnish to PREPA a certificate from the Puerto Rico State Insurance Fund showing that all personnel employed in the work are covered by the Workmen's Compensation Insurance, in accordance with this Contract. -----

19.2 Employer's Liability Insurance

The Contractor shall provide Employer's Liability Insurance with minimum bodily injury limits of \$1,000,000 for each employee and \$1,000,000 for each accident, covering against the liability imposed by Law upon the contractor as a result of bodily injury, by accident or disease, including death arising out of and in the course of employment, outside of and in the course of employment, and outside of and distinct from any claim under the Workmen's Compensation Act of the Commonwealth of Puerto Rico.-----

19.3 Commercial General Liability Insurance

The Contractor shall provide a Commercial General Liability Insurance with limits of \$1,000,000 per occurrence and \$1,000,000 aggregate. This Policy shall include a completed operations and products coverage.-----

19.4 Commercial Automobile Liability Insurance

The Contractor shall provide an Automobile Liability Insurance with limits of \$1,000,000 combined single limit covering all owned, non-owned and hired automobiles.-----

19.5 Professional Liability Insurance

The Contractor shall provide a Professional Liability Insurance with limits of \$1,000,000 per claim and \$1,000,000 per aggregate.-----

Requirements Under the Policies:

The Commercial General Liability and Automobile Liability Insurance required under this Contract, shall be endorsed to include:

A. As additional insured:

Puerto Rico Electric Power Authority
Risk Management Office
PO Box 364267
San Juan, PR 00936-4267

- B. A 30 days cancellation or nonrenewable notice to be sent to the above address.
- C. An endorsement including this Contract under contractual liability coverage and identifying it by number, date and parties to the Contract.
- D. Waiver of Subrogation in favor of PREPA.
- E. Breach of Warranties or Conditions:

“The Breach of any Warranties or Conditions in these policies by the Contractor shall not prejudice PREPA’S rights under this policy.”

Bonds

As a Contract security, the Contractor shall furnish at any time before the execution of the Contract:-----

A Performance Bond in the amount of one hundred percent (100%) of the contract price, with good and sufficient surety satisfactory to the Authority guaranteeing that the contractor will well and faithfully perform the contract work.-----

A Payment Bond in the amount of one hundred percent (100%) of the contract price, with good and sufficient surety satisfactory to the Authority to guarantee the prompt

payment of all labor, supervision, equipment and materials required in the performance of the work.-----

All bonds shall be issued in the official form of PREPA.-----

Furnishing of Policies:

All required policies of insurance shall be in a form acceptable to the Authority and shall be issued only by insurance companies authorized to do business in Puerto Rico.-----

The Contractor shall furnish a certificate of insurance in original signed by an authorized representative of the insurer in Puerto Rico, describing the coverage afforded.-----

ARTICLE 20. Permits and Licenses

The Contractor shall obtain, maintain and submit evidence of all the licenses, permits and authorizations required to perform all Services and tasks under this Contract, and shall send all notices, pay all fees, and related costs and will comply and will have its subcontractors if any, and agents comply with all laws, ordinances, rules, and regulations applicable to the Services. -----

ARTICLE 21. Other Contracts

PREPA may award other contracts for additional work, and the Contractor shall fully cooperate with such other contractors, in accordance with ARTICLE 6. Other Work at the Site, of this Contract, and carefully fit his own work to that provided under other contracts as may be directed by the Contracting Officer. The Contractor shall not commit or permit any acts, which interfere with the performance of work by any other contractor. -----

ARTICLE 22. Claims for Labor and Materials

The Contractor shall, at his own expense, assume the defense of and save harmless PREPA from claims arising out of and in connection with Contractor furnished labor and materials, and PREPA shall not suffer any mechanics or other liens to remain outstanding against any property used in connection with the Services; and shall, on request, furnish satisfactory evidence that all persons who have done work or furnished materials have been fully paid. If the Contractor fails to comply with his obligations in this respect, PREPA may take such liens or claims and may withhold from any monies due to the Contractor such amounts as may be necessary to satisfy and discharge any such claims and any cost and expense incidental thereto.-----

ARTICLE 23. Minimum Wage Rates

The Contractor and all subcontractors shall comply with the requirements prescribed by the federal Davis-Bacon Act (Public Law 107-217- August 21, 2002 as amended, 40 USC §3141 et seq.). As therein required, contractors and subcontractors performing on contracts funded directly by or assisted in whole or in part with American Recovery and Reinvestment Act appropriations in excess of \$2,000 shall pay all laborers and mechanics not less than the locally prevailing wage rates and fringe benefits, as determined by the Secretary of Labor, for corresponding classes of laborers and mechanics employed on similar projects in the area.-----

ARTICLE 24. Unfair Labor Practice

In the event that the Contractor or any of his subcontractors or agents do not comply with an order issued by the Puerto Rico Labor Relations Board and/or the National Labor Relations Board upon their finding that the Contractor or any of his subcontractors or agents have committed an unfair labor practice, no further payments shall be made by PREPA to the Contractor after the date of the said order. In addition, the Contract may be terminated by PREPA, in which case PREPA may take possession of the materials, tools, and appliances on the job site and finish the work by whatever method it may deem expedient. Any declaration by the Puerto Rico Labor Relations Board and/or by the National Labor Relation Board that the contractors or agents have not complied with an order issued by the Board relating to any unfair labor practice, shall be binding, final, and conclusive unless such order is reversed or set aside by a Court of competent jurisdiction.-----

ARTICLE 25. Assignment

This Contract or any interest therein or any monies due or to become due there under shall not be assigned, mortgaged or otherwise disposed of without the previous consent in writing of the Contracting Officer. -----

ARTICLE 26. Subcontractors

The Contractor shall not subcontract its rights and obligations under this Contract, except in the event PREPA gives written authorization for such actions. Provided that no subcontract shall be considered for PREPA's approval, except when the following requirements are met: (1) the Contractor delivers PREPA a complete, non-marked copy of the signed subcontract, not less than thirty (30) days prior to the effective date of the proposed subcontract; (2) the subcontract includes, as a condition for its legal validity and enforceability, a provision whereby PREPA has the right to substitute, subrogate or assume Contractors' rights under the subcontract, in the event that PREPA declares the Contractor in breach or default of any of the Contract terms and conditions; and (3) the subcontract includes, as a condition for its validity and enforceability, a provision

establishing for the subcontractor the obligation to comply unconditionally and entirely with all Contractors' obligations under the Contract (*mirror image rule*), except for such obligations, terms and conditions which exclusively related with works or services not included under the subcontract.-----

ARTICLE 27. Novation

Contractor and PREPA agree that no amendment, during its term, it's understood as a contractual novation, unless both Parties agree to the contrary, specifically in writing. The previous provision shall be equally applicable in such other cases where PREPA gives the Contractor a time extension for the compliance of any of its obligations under the Contract or where PREPA dispenses the claim or demand of any of its credits or rights under this Contract. -----

ARTICLE 28. Patents and Copyrights

The Contractor, at its own expense, shall defend any suit or action brought against PREPA based on a claim that any equipment or part thereof, copyright or un-copyrighted composition, secret process, patented or unpatented invention, article, or appliance manufactured or used in the performance of this Contract, including their use by PREPA, constitutes an infringement of any patents or copyrights of the United States, if notified promptly in writing by PREPA, and given the authority, information, and assistance for the defense of the same, and the Contractor shall pay all damages and costs awarded therein against PREPA. If in such suit the equipment or any part thereof, or the composition, secret process, invention, article or appliance, is held to constitute infringement and its use is enjoined, the Contractor, at its option and expense, shall either procure for PREPA the right to continue using the same or replace it with non-infringing equipment, composition, secret process, invention, article or appliance, or modify it so it becomes non-infringing; or remove it and refund the purchase price.-----

ARTICLE 29. Waivers

No waiver of any breach of this Contract shall be held to be a waiver of any other subsequent breach. All remedies afforded by PREPA in this Contract shall be taken and construed as cumulative, that is, in addition to every other remedy provided herein or by law.-----

ARTICLE 30. Disputes

Except as otherwise specifically provided in this Contract, all disputes concerning questions of fact arising under this Contract shall be decided by the Head, Engineering and Technical Services Division, subject to written appeal by the Contractor within

thirty (30) days to the Contracting Officer. As soon as practicable thereafter, the Contracting Officer shall inform each party hereto of his decision regarding the dispute, which decision shall be final and conclusive upon the parties hereto, unless such decision is challenged, with in sixty (60) days, on the basis of being arbitrary, malicious or capricious. If such challenge is made, either party may pursue its remedy at law or equity. In the meantime, the Contractor shall diligently proceed with the work as directed. -----

If no written appeal to the decision by the Contracting Officer is made by the Contractor within the above established timeframe, the Contracting Officer's decision on the dispute shall be deemed final and conclusive and no further remedy shall be pursued by the Contractor. -----

ARTICLE 31. Correction of Work After Final Payment

Neither the final certificate for payment nor any provision in the Contract documents shall relieve the Contractor of responsibility for faulty materials or workmanship and, unless otherwise specified, he shall remedy any defects due thereto and pay for any damage to other work resulting therefore, which shall appear within a period of one (1) year after final acceptance. PREPA shall give notice of observed defects with reasonable promptness. All questions arising under this Article shall be decided by the Engineer, subject to appeal by the Contractor, as provided in ARTICLE 33. Disputes, of this Contract.-----

ARTICLE 32. Laws to be Observed

Contractor shall observe and comply with any and all federal, insular and municipal laws, ordinances and regulations that in any manner affect the Services, and shall observe all such orders and decrees as exist at present or may be enacted prior to the completion of the Services by agencies or courts having any jurisdiction or authority. Contractor shall save harmless and indemnify PREPA and its representatives, officers, agents and servants for fines and penalties paid by PREPA, including attorney's fees, to governmental authorities as sole result of Contractor's violation of any such law, ordinance, regulation, order or decree, whether by Contractor or its employees, subject to limits of liability in Article 15. Liabilities. -----

ARTICLE 33. Change of Law

During the term of this Contract, any change in law, including, but not limited to changes in applicable tax law, which causes an increase in Contractor's costs when supplying the products or services to be acquired by PREPA, shall be of Contractor's responsibility and PREPA shall not be obliged to make additional payments nor to pay additional sums to the Contract Amount for those products or services. -----

ARTICLE 34. Choice of Law

During the term of this Contract, any change in law, including, but not limited to changes in applicable tax law, which causes an increase in Contractor's costs when supplying the products or services to be acquired by PREPA, shall be of Contractor's responsibility. PREPA shall not be obliged to make additional payments nor to pay additional sums to the Contract Amount for those products or services.-----

ARTICLE 35. Separability

If a court of competent jurisdiction declares any of the Contract provisions as null or invalid, such holding will not affect the validity and effectiveness of the remaining provisions of the Contract and the Parties agree to comply with their respective obligations under such provisions not included by the judicial declaration.-----

ARTICLE 36. Warranty

The Contractor warrants that all materials, parts, equipment and work performed under this Contract comply in all respect with its terms and conditions; that they are free from defects in materials and workmanship; that they are suitable and adequate for the purposes for which they were designed and for such other purposes, and that the Services provided under this Contract will conform with the highest standards of care and practice appropriate to their nature. The warranty period will begin the date on which PREPA accepts the Services and will continue for a period of one (1) year. The Contractor will, upon written notice by PREPA, fully remedy, free of expense to PREPA, any defects as may develop on Services. The Performance Bond shall cover and serve as guarantee for this warranty.-----

For those materials, parts, equipment, which prove defective or deficient during the warranty period, the Contractor shall, at his own expense, repair or replace, transport-in, from Contractor's facilities to PREPA's site, and transport-out, from PREPA's site to Contractor's facilities, such materials, parts, and/or equipment. The Performance Bond shall cover and serve as guarantee for the Contractor's failure, completely or in part, to properly perform his obligations under this Contract.

ARTICLE 37. Notice

Any required notice to be given hereunder shall be in writing and will be sufficiently served when delivered in person or properly mailed to the following addresses:

To PREPA:	Puerto Rico Electric Power Authority
	PO Box 364267

San Juan, Puerto Rico 00936-4267

Attention: Carlos Negrón Alfonso
Administrator on Generation

To Contractor: [Contractor's Name]
[Mailing Address]

Attention: [Contractor's representative]

ARTICLE 38. Income Tax Withholding

PREPA will deduct and withhold at source to the Contractor the equivalent of seven percent (7%) from payment for services rendered under this Contract, in compliance with the Internal Revenue Code for a New Puerto Rico, Act No. 1-2011, as amended, section 1062.03. Notwithstanding, the withholding to be done by PREPA as herein stated could be increased to twenty percent (20%) in the event that the Contractor is a non resident individual, which is a U.S. citizen, as provided by the Act No. 1-2011, section 1062.08; or twenty-nine percent (29%) in the event that the Contractor is a non resident and non U.S. citizen individual; or a foreign corporation or partnership which is not dedicated to industry or business in Puerto Rico, as provided by Act No. 1-2011, section 1062.08.-----

If a Release Letter is issue to the Contractor by the Treasury Department, the Contractor shall be responsible to submit a copy of said Release Letter to PREPA for every calendar year; otherwise, payments under the Contract shall remain subject to withholding at source.-----

All invoices shall be segregated by concepts (services, materials, equipment, etc.), to identify the amounts subject to withholding and avoid undue deductions.-----

ARTICLE 39. Discrimination

The Contractor certifies that he is an employer with equal opportunity employment, and do not discriminate by race reason, color, gender, age, national or social origin, social status, political ideas or affiliation, religion; for being or perceived to be a victim of domestic violence, sexual aggression or harassment, regardless of marital status, sexual orientation, gender identity or immigration status; for physical or mental disability, for veteran status or genetic information. -----

ARTICLE 40. Other Taxes

All unemployment, retirement, and other Social Security contributions and taxes; all sales, use and excise, privilege, business and occupational taxes, and any other taxes or fees payable by the Contractor are and shall be included as part of his prices.-----

ARTICLE 41. Cleaning Up

The Contractor shall remove from PREPA's property and from all public and private property all temporary structures no longer required, rubbish, and waste materials resulting from his operations.-----

Upon completion of Services, the Contractor shall remove all remaining rubbish, unused materials and other like material, belonging to him or used under his direction during the installation of the equipment. In the event of his failure to do so, PREPA may remove the same at the Contract's expense, and his surety or sureties shall be liable therefore.

ARTICLE 42. Use of Completed Portions

PREPA shall have the right to take possession of and use any completed or partially completed portions of the work, notwithstanding the fact that the time for completion of the entire work may not have expired, but such taking possession and use shall not be deemed an acceptance of the work so taken or used or any part thereof. PREPA may require the Contractor to expedite the completion of any part of the work for provisional use by PREPA and the Contractor shall comply with such request. If such order of completion or prior use increases the cost of the work or delays the work, the Contractor shall be entitled to such extra compensation or extension of time as agreed by the Parties.-----

ARTICLE 43. Quality Assurance

The Contractor shall submit for evaluation and approval by PREPA a quality control program and establish a quality assurance program, also evaluated and approved by PREPA, to satisfy all applicable regulation and requirements specified in the procurement documents and satisfactory to PREPA. The program shall contain all those measures necessary to assure that all basic technical requisites ask for in the drawings, codes, tests, and inspections for design, fabrication, cleaning, installation, packing, handling, shipping, long term storage, when necessary, and test equipment are fulfilled. PREPA reserves the right to conduct audits and inspections to the facilities, activities, and/or documents when estimated and without previous notification necessary in order to assure that the quality control program is adequate and properly implemented. -----

The Contractor shall allow PREPA access to its facilities and documents, so that PREPA, through audits and inspections can verify the quality of the labor, equipment, products, services, and any other related items provided by the Contractor. In every case in which the materials or services furnished to PREPA are subcontracted partially or totally, by the Contractor, the Contractor shall request the subcontractor to accept and comply with all the requirements of this Article. -----

ARTICLE 44. Safety Provisions

- 44.1 The Contractor shall have an Occupational Safety and Health Program. A copy of this Program will be delivered to the Occupational Safety Department. The Program shall comply with the following minimum requirements of a health and safety program:-----
- a. It shall comply with all requirements from all applicable regulations included in the 29 CFR 1900.1. The Program shall have been updated within the past year from the delivery date to PREPA.-----
 - b. It shall establish the mechanisms used to update and audit compliance with itself.-----
 - c. It shall include an accident or incident investigation procedure. This procedure will always include the preparation of a report, which will be submitted to the Occupational Safety Department of PREPA.-----
- 44.2 The Contractor shall submit, for evaluation by the Occupational Safety Department, a copy of a Site Specific Work Plan. This plan shall include, but not be limited to, the following aspects:-----
- a. Objectives of the Work Plan-----
 - b. Description of the activities -----
 - c. Occupational safety and health considerations to be addressed before commencement of the project.-----
 - d. Procedures for achieving compliance with the applicable regulations, including, but not limited to:-----
 - i. Occupational Exposure to Lead (29 CFR 1926.62)
 - ii. Scaffolds (29 CFR 1926 Subpart L)
 - iii. Confined Spaces (29 CFR 1910.146)
 - iv. Occupational Exposure to Noise (29 CFR 1910.95)
 - v. Hazardous Materials (29 CFR 1910 Subpart H)
 - vi. Personal Protective Equipment (29 CFR Subpart I)
 - vii. Hazard Communication (29 CFR 1910.1200)
 - viii. HAZWOPER (29 CFR 1910.120)
 - ix. Fire Protection (29 CFR 1910 Subpart L)
 - x. Commercial Diving (29 CFR 1910 Subpart T)
 - xi. Respiratory Protection (29 CFR 1910.134)

- xii. Fall Protection (29 CFR 1926 Subpart M)
 - xiii. Electrical (29 CFR 1926 Subpart K)
 - xiv. Welding (29 CFR 1926 Subpart J)
 - xv. Excavations (29 CFR 1926 Subpart P)
 - xvi. Demolitions (29 CFR 1926 Subpart T)
 - xvii. Blasting & Explosives (29 CFR 1926 Subpart U)
 - xviii. Ventilation (29 CFR 1926.57)
 - xix. Tools, Hand, and Powered (1926 Subpart I)
 - xx. Electric Industry (29 CFR 1910.269)
 - xxi. Lockout/Tagout (29 CFR 1910.147)
 - xxii. Asbestos (29 CFR 1910.1001)
- e. It will also include any other regulation or guidelines related to safety and health that could be applicable to the scope of work, and contingency procedures that include how to proceed in an emergency situation, such as fire or chemical spill, among others. -----
- f. A list of all specialized personnel needed. Also, include copy of all training certificates, licenses or certifications required, according to the scope of work. For example: pesticide applicator, electrician, spill responder, refrigeration technician, DOT training for hazardous substances, etc. All these certificates and licenses shall be up to date. -----
- g. Copy of the Material Safety Data Sheets (MSDS) of all chemical products to be used during the project, for evaluation and approval by PREPA's Occupational Safety and Health Office (Hazard Communication Section).
- h. Certification of compliance with medical surveillance requirements, according to scope of work. -----
- i. Certification of compliance with Fit Test requirements for the use of respirators that make a face seal. -----
- j. Safety equipment and materials to be used during the project.-----
- k. Procedures to verify the work area after each work day and at the end of the project. -----
- l. Each Contractor/Subcontractor shall comply with a 100% drug /alcohol free work zone. At minimum, pre-project and post accident testing is required. A positive post accident test or positive pre-project test will result in worker dismissal from the project. Testing will be performed in following closely the NIDA standards. -----
- 44.3 Before commencement of work, the Contractor shall take part in a coordination meeting with the designated Safety Officer and Construction Manager, and the project manager on PREPA's behalf. During this meeting the areas to be worked on will be toured, the site specific work plan will be discussed and reviewed, and amendments to it could be required. -----
- 44.4 If the contracted services include demolition activities (as defined per ANSI A10.6 – 1990: Demolition – the dismantling, razing or wrecking of any

- fixed building or structure or any part thereof) that will be carried out in buildings or structures, that because of their construction date or prior use, are suspected to contain asbestos, lead based paint or other hazardous materials, the Contractor will require a certification from the project manager or owner stating that the building or structure is free of such materials.-----
- 44.5 Services including activities inside buildings occupied by working personnel, that could create a hazard to their safety or health, will be offered AFTER PREPA'S WORKING HOURS. The Contractor will take all steps necessary to assure the area will be free of nuisance odors or vapors before is reoccupy by PREPA's personnel. All these will be done in coordination with PREPA's local supervisor.-----
- 44.6 The Contractor shall assure that all wastes are removed and properly disposed of, in accordance with all applicable laws and regulations, at the end of every work shift and after the completion of the project.-----
- 44.7 All chemical products to be used shall be classified as Approved or Conditionally Approved by PREPA's Hazard Communication Section.-----
- 44.8 Welding operations will comply with the requirements of OSHA, ANSI and NFPA.-----
- 44.9 If the project involves the handling of non-asbestos insulation or other dust generating materials, like gypsum board, steps shall be taken to prevent the release of the dust to adjacent areas49.10 The Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to all employees on the work and all other persons who may be affected. Also, to the work, property, material and equipment on or off the site, under the care, custody or control of the Contractor or any of his subcontractors.-----
- 44.10 The Contractor shall comply with all applicable laws, ordinances, rules, regulations and lawful orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. He shall erect and maintain, as required by existing conditions and progress of the work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.-----
- 44.11 The Contractor shall designate a responsible Safety Officer of his organization, evaluated and approved by PREPA, who shall be at all times at the project site, whose only duty shall be the prevention of accidents, implement both the Safety and Health Program and the Site Specific Work Plan in coordination with the Safety Officer from PREPA. The Contractor's Safety Officer shall had successfully completed the thirty (30) hours Occupational Safety and Health Administration course in occupational safety and health standards for the construction industry. Contractor shall also have on site available at any time the latest revision of the OSHA Standards for the Construction Industry Manual.

- 44.12 Compliance with all safety provisions by subcontractors shall be the responsibility of the Contractor.-----
- 44.13 Contractor agrees that it shall perform all work in compliance with federal, state and local occupational safety and health regulations, as described in the Site Specific Work Plan.-----
- 44.14 Contractor will obtain and maintain, during the duration of the Contract, the proper permits from all federal, state and local regulatory authorities or other applicable government agency with respect to discharge, disposal, use, storage, handling and transportation of hazardous chemicals and substances as and when applicable law or regulation requires. For projects including the handling of asbestos, lead, or spilled hazardous substances, the notification to EPA or the EQB will be done by the Contractor, but in coordination with the Safety Officer and the Environmental Advisor or Officer.-----
- 44.15 Contractor will not cause or permit any hazardous chemical or product containing a hazardous chemical to be at, or in the vicinity of, any place where any employee, agent, or contractor of PREPA, or any employee of any such agent or Contractor, may be at risk or exposed to hazard as a result thereof during normal use or any foreseeable emergency.-----
- 43.16 Contractor will defend, indemnify and hold harmless, PREPA, its employees, agents or assignees for any and all direct liabilities and expenses arising out of contractor noncompliance with these clauses irrespective of any other terms of this Contract.-----

ARTICLE 45. Environmental Liabilities

The Contractor agrees to indemnify PREPA for all expenses and costs of any nature arising out of any claim due to an environmental violation, caused by his agents, employees, subcontractors or assigns during the performance or non-performance of its obligations under the Contract. The Contractor shall have available, and close to the working area, the necessary equipment to control and pick-up any spills that could occur during the performance of the work required by the Contract. The equipment should include all the necessary materials for the waste disposal. All equipment to be used in the work area should be free of oil, transmission fluid or hydraulic fluid leakages. If the equipment develops a leakage during the work process, it should be repaired or replaced immediately. The Contractor shall inform and coordinate with the Supervisor of the Environmental Section any work to be done to avoid any environmental violation. The Contractor shall comply with all the arrangements established in the Consent Decree between PREPA and the Environmental Protection Agency.-----

PREPA shall dispose of all waste generated because of this work, according to the Environmental regulations. The use of PREPA's waste disposal equipment by the Contractor is not permitted. -----

The Contractor, upon completion of the work, shall hand-in the assigned work area free of contaminants according to the laboratory analysis before and after the work. Before starting the work, the Contractor shall submit the work plan to PREPA for evaluation of the Environmental Protection Division. -----

All chemical analysis shall be performed by PREPA at an approved laboratory. PREPA's personnel will audit the sampling and the disposal of waste material. -----

The disposal of non-hazardous and hazardous waste material shall be done in a PREPA approved landfill. -----

The Contractor shall submit evidence of compliance with 49 CFR 72 Sub. Part H (DOT).

A company previously approved by PREPA will perform all remedial actions and environmental work. All work shall be performed according to the Best Management Practice Plan (BMPP), which is part of the Special Conditions of the NPDES Permit.-----

ARTICLE 46. Compliance with the Commonwealth of Puerto Rico Contracting Requirements

The Contractor will comply with all applicable State Law, Regulations or Executive Orders that regulate the contracting process and requirements of the Commonwealth of Puerto Rico. Particularly: -----

- A. Executive Order OE-1991-24 of June 18, 1991 to require certification of compliance with the Internal Revenue Services of the Commonwealth of Puerto Rico:
Pursuant to Executive Order OE-1991-24 of June 18, 1991, the Contractor will certify and guarantee that it has filed all the necessary and required income tax returns to the Government of Puerto Rico for the last five (5) years. The Contractor, further will certify that it has complied and is current with the payment of any and all income taxes that are, or were due, to the Government of Puerto Rico. The Contractor shall provide, to the satisfaction of PREPA, and whenever requested by PREPA during the term of this Contract, the necessary documentation to support its compliance with this clause. The Contractor will be given a specific amount of time to produce said documents. During the term of this Contract, the Contractor agrees to pay and/or to remain current with any repayment plan agreed to by the Contractor with the Government of Puerto Rico. Executive Order 1991OE24.-----
- B. Executive Order OE-1992-52 of August 28, 1992 to require certification of compliance with the Department of Labor of the Commonwealth of Puerto Rico.
Pursuant to Executive Order 1992-52, dated August 28, 1992 amending OE-1991-24, the Contractor will certify and warrant that it has made all payments required for unemployment benefits, workmen's compensation and social security

for chauffeurs, whichever is applicable, or that in lieu thereof, has subscribed a payment plan in connection with any such unpaid items and is in full compliance with the terms thereof. The Contractor accepts and acknowledges its responsibility for requiring and obtaining a similar warranty and certification from each and every Contractor and Sub Contractor whose service the Contractor has secured in connection with the services to be rendered under this Contract and shall forward evidence to PREPA as to its compliance with this requirement. Executive Order 1992OE52.-----

- C. Social Security and Income Tax Retentions: In compliance with Executive Order 1991 OE- 24; and C.F.R. Part 404 et. Seq., the Contractor will be responsible for rendering and paying the Federal Social Security and Income Tax Contributions for any amount owed as a result of the income, from this Contract. Executive Order 1991OE24; C.F.R. Part 404 et. Seq.-----

- D. Government of Puerto Rico Municipal Tax Collection Center: The Contractor will certify and guarantee that it does not have any current debt with regards to property taxes that may be registered with the Government of Puerto Rico's Municipal Tax Collection Center (known in Spanish as *Centro de Recaudación de Ingresos Municipales* ("CRIM"). -----

The Contractor further will certify to be current with the payment of any and all property taxes that are or were due to the Government of Puerto Rico. The Contractor shall provide, to the satisfaction of PREPA and whenever requested by PREPA during the term of this Contract, Certification issued by the Municipal Revenues Collection Center (MRCC), assuring that Contractor does not owe any tax accruing to such governmental agency. To request such Certification, Contractor will use the form issued by the MRCC (called "*CRIM-Certificados, Radicación, Estado de Cuenta y Todos los Conceptos*" in the website). -----

- E. Puerto Rico Child Support Administration (ASUME): The Contractor shall present, to the satisfaction of PREPA, the necessary documentation certifying that the Contractor nor any of its owners, affiliates of subsidiaries, if applicable, have any debt, outstanding debt, or legal procedures to collect child support payments that may be registered with the Puerto Rico Child Support Administration (known in Spanish as the *Administración Para el Sustento de Menores (ASUME)*). The Contractor will be given a specific amount of time to deliver said documents. 3 L.P.R.A. § 8611 et seq.-----

- F. Certificate of Incorporation, or Certificate of Organization or Certificate of Authorization to Do Business in Puerto Rico issued by the Puerto Rico Department of State.-----

- G. Good Standing Certificate issued by the Puerto Rico Department of State.-----
- H. The Contractor hereby certifies that it does not represent particular interests in cases or matters that imply conflicts of interest, or of public policy, between the executive agency and the particular interests it represents.-----
- I. Articles extracted, produced, assembled, packaged or distributed in Puerto Rico by enterprises with operations in Puerto Rico, or distributed by agents established in Puerto Rico shall be used when the service is rendered, if they are available.-----
- K. If any of the previously required Certifications shows a debt, and Contractor has requested a review or adjustment of this debt, Contractor will certify that it has made such request at the time of the Contract execution. If the requested review or adjustment is denied and such determination is final, Contractor will provide, immediately, to PREPA a proof of payment of this debt; otherwise, Contractor accepts that the owed amount be offset by PREPA and retained at the origin, deducted from the corresponding payments.-----

Contractor recognizes that submittal of the aforementioned certifications and documents is an essential condition of this Contract; and even in the case that they are partially incorrect, there will be sufficient cause for PREPA to terminate, cancel or rescind the Contract, and Contractor have to refund all payments received.-----

ARTICLE 47. Anti-Corruption Code for a New Puerto Rico.

Contractor agrees to comply with the provisions of Act 2-2018, as the same may be amended from time to time, which establishes the Anti-Corruption Code for a New Puerto Rico. The Contractor hereby certifies that it does not represent particular interests in cases or matters that imply a conflicts of interest, or of public policy, between the executive agency and the particular interests it represents.-----

Contractor shall furnish a sworn statement to the effect that neither Contractor nor any president, vice president, executive director or any member of a board of officials or board of directors, or any person performing equivalent functions for Contractor has been convicted of or has pled guilty to any of the crimes listed in Article 6.8 of Act 8-2017, as amended, known as the Act for the Administration and Transformation of Human Resources in the Government of Puerto Rico or any of the crimes included in Act 2-2018.-----

Contractor hereby certifies that it has not been convicted in Puerto Rico or United States Federal court for under Articles 4.2, 4.3 or 5.7 of Act 1-2012, as amended, known as the Organic Act of the Office of Government Ethics of Puerto Rico, any of the crimes listed in Articles 250 through 266 of Act 146-2012, as

amended, known as the Puerto Rico Penal Code, any of the crimes typified in Act 2-2018, as amended, known as the Anti-Corruption Code for a New Puerto Rico or any other felony that involves misuse of public funds or property, including but not limited to the crimes mentioned in Article 6.8 of Act 8-2017, as amended, known as the Act for the Administration and Transformation of Human Resources in the Government of Puerto Rico.-----

PREPA shall have the right to terminate the Contract in the event Contractor is convicted in Puerto Rico or United States Federal court for under Articles 4.2, 4.3 or 5.7 of Act 1-2012, as amended, known as the Organic Act of the Office of Government Ethics of Puerto Rico, any of the crimes listed in Articles 250 through 266 of Act 146-2012, as amended, known as the Puerto Rico Penal Code, any of the crimes typified in Act 2-2018, as amended, known as the Anti-Corruption Code for a New Puerto Rico or any other felony that involves misuse of public funds or property, including but not limited to the crimes mentioned in Article 6.8 of Act 8-2017, as amended, known as the Act for the Administration and Transformation of Human Resources in the Government of Puerto Rico.-----

ARTICLE 48. Correlation of Documents

In case of discrepancy or in the event of conflict among the different Contract documents such as: Contract, Special Conditions, Technical Specifications, Drawings, Proposal Forms, and the Contractors Bidding Proposal, these shall take precedence in the order given.-----

The terms and conditions contained in the Contract shall prevail over any conflictive terms and conditions contained in the Contractor's Bidding Proposal. -----

ARTICLE 49. Transformation Process

The Parties acknowledge that PREPA is undergoing a transformation process, and therefore, both Parties agree that in the eventuality of the execution of a Partnership Contract, Sale Contract or any other PREPA Transaction (as these terms are defined in Act 120-2018), PREPA may sell, assign, convey, transfer, pledge, mortgage, sublease, delegate, hypothecate, or otherwise dispose (each, a "Transfer") any of its rights, title, or interest in this Agreement as permitted by applicable law and at any time, and without Contractor's consent or cost, expense or incremental liability to PREPA, to any future operator of Puerto Rico's electric power transmission and distribution system or any of its affiliates, or to any governmental agency, body, public corporation or municipality of Puerto Rico; provided, that PREPA shall notify Contractor no later than thirty (30) days before the effective date of any such Transfer.-----

ARTICLE 50. Provisions Required Under Joint Memorandum 2017-001 of the
Governors Chief of Staff and the Office of Management and Budget

- (1) Both contracting parties acknowledge and accept that the contracted services may be rendered to any entity of the Executive Branch with which the contracting entity enters into an interagency Contract with or as determined by the office of the Chief of Staff. These services shall be rendered under the same terms and conditions with respect to work hours and compensation, as set forth in this Contract. For purposes of this provision, the term "entity of the Executive Branch" includes all agencies of the Government of Puerto Rico as well as all instrumentalities and public corporations. -----
- (2) The office of the Chief of Staff shall have the authority to terminate this Contract at any time.-----

ARTICLE 51. Complete Agreement

This document, together with all attachments referenced herein, constitutes the complete agreement between the Parties. -----

IN WITNESS WHEREOF, the Parties hereto have executed this Contract this _____ day of _____ of the year _____, in San Juan, Puerto Rico.

PUERTO RICO ELECTRIC POWER
AUTHORITY OF PUERTO RICO

CONTRACTOR

BY: _____
José F. Ortiz Vázquez
Chief Executive Officer/Executive Director
Social Security Number 660-43-3747

BY: _____
Name
Title
Social Security Number

SECTION 15010
SPECIAL CONDITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This section includes: PREPA drawings, general contract provision, supplementary conditions, inspection reports and other technical sections.

a) Inspection Reports

TEAM Industrial Services, Inc.

TK-S10 Internal Visual and Ultrasonic Inspection Report (April 4, 2017)

- B. The following additional sections are part of this specification:

- a) Section 09900 – Paint
- b) Section 15455 – Storage Tank
- c) Section 15456 - Hazard Material Procedure Handling
- d) Section 15457 – Confined Space

- C. Whenever in these specifications there are listed specific brands and models of products, it will be understood as equal or approved equal to said products.

1.2 SUMMARY

- A. Scope of work: Work shall include all labor, materials, equipment, tools, supervision, and services for the rehabilitation SJSP Fuel Oil #6 Service Tank S-10 internal and external surfaces. All the required work will be at the San Juan Steam Plant facilities, except otherwise noted. Contractor shall be responsible for all required rigging and safety. Also, the contractor shall be responsible for the appropriate stores of the coatings, grit blast material and equipment.
- B. All works shall be performed in a safe and workmanlike manner and in conformance with Codes, Standards, Local Rules, Regulations and

San Juan Steam Plant
Fuel Oil #6 Service Tank S-10 Rehabilitation
RFP 0002682

Ordinances, etc. of government agencies having jurisdiction, including but not limited to the following:

- a) The Environmental Protection Agency (EPA).
 - b) The Office of Safety and Health Administration (OSHA) requirements.
 - c) ACI -318 (latest revision).
 - d) Environmental Quality Board
 - e) American Petroleum Institute API - 2610 Design, Construction Operation, Maintenance & Inspection of Terminal and Tank Facilities.
 - f) NFPA-30- Flammable and Combustible Liquid Code
 - g) 29 CFR 1910, 40 CFR 112 (latest revision)
 - h) American Society for Testing and Materials, ASTM.
 - i) EPA NPDES Permit for San Juan Power Plant.
- C. All analysis shall be made by a PREPA approved laboratory.

1.3 REQUIRED DOCUMENTS

- A. Bidders shall submit evidence of required experience of at least three (3) years in related works. The required experience shall be a list of similar projects (past or ongoing) where the following conditions are or were met:
 - a) Full enclosure of working area
 - b) Sandblasting of metal surfaces and capacity (CFM) of the compressor used for the work.
 - c) Use of airless spray or plural component equipment. Specify if equipment was rented or own by the company.
- B. Contractor shall provide a work schedule for the project. This schedule will be reviewed and approved by the Engineer prior to commencing work.
- C. Material Safety Data Sheets (MSDS) of all chemical products required for the project shall be submitted for approval to the Hazard Communication Section at the Safety Division of PREPA. Once approved the Contractor shall keep a

copy of the MSDS on the site.

- D. Contractor shall provide submittals for the products specified in each of the Technical Specifications.
- E. The Contractor shall provide any technical reference manuals or operational and maintenance information available, for any equipment being installed.
- F. Contractor shall submit for evaluation, a site specific Work Plan, including how to comply with the applicable environmental, safety and health regulations. Before the commencement of work, the Contractor shall participate in a meeting with PREPA's Safety Officer and the Project Manager, for a job briefing and a visit to the work area.
- G. Contractor shall submit results of all laboratory tests required.

1.4 RECORD DRAWINGS

- A. Contractor shall keep, at the site of work, a complete set of drawings for the purpose of noting thereon on a continuous basis, all field changes during construction. Changes will be marked in red.
- B. This set of provisional record drawings will be kept up to date with all changes noted thereon, and they shall be submitted for the inspection and approval of the Engineer, when requested.
- C. Upon termination of the installations, record drawings will be delivered through the Engineer to the Design and Drawing Department showing all as-built condition before final liquidation of Contract.

1.5 GENERAL REQUIREMENTS

- A. It is the responsibility of the Contractor to coordinate with the Engineer the presence of any underground existing facilities, such as electrical conduits, cables, fuel lines, water lines, etc., which could be affected during construction.
- B. Contractor shall coordinate with the site's Operations Manager and with the Engineer the schedule for performing works as specified and required.
- C. Maintaining site operations is a priority for PREPA, so it shall be considered as an essential condition of this contract. As such, contract works cannot expose conflict with normal plant and is the responsibility of the Contractor to coordinate with the Engineer a work program that provides normal operation

of the site during project progress.

The operational scheme for site operations relies solely on PREPA, so any order by PREPA to stop contractor works or any delay related to PREPA granting availability of any area, equipment or material shall be considered as a foreseeable event.

- D. In the event contractor is unable to perform works due to any operational, maintenance, security or safety related determinations by PREPA, contractor's only remedy shall be an extension of time for performing his contract obligations.
- E. Contractor works to be performed close or adjacent to any facility or equipment in service shall be coordinated with the Engineer and the site's Operations Manager. Full access to PREPA personnel to all areas in service or available for being in service shall be guaranteed at all times by contractor.
- F. Before start working the Contractor shall meet with designated health and safety personnel to establish specific safety and health precautions.
- G. It is the intention of these specifications and drawings to develop the work until the project is completed. That the necessary tests are done and the system is left operational. The Contractor is responsible for any details that usually are not found in the drawings or specifications provided by PREPA, as there shall be a final design, certified issued for construction drawings under the full responsibility of the Contractor and approved by PREPA. Said details shall be included in the work, just as the ones specified and shown in the drawings.
- H. The Engineer can reject all materials and work done by the Contractor not according to the provided drawings, specifications or contract. The Contractor will replace all the material and perform the necessary labor to correct the work or rejected material at his own cost, to the Engineer's satisfaction.
- I. If any errors or omissions occur, the Contractor shall notify the Engineer prior to submitting his proposal, so the necessary revisions or adjustments are made.
- J. It is the Contractor's responsibility to certify that documents submitted for approval does not deviate from the contract specifications. Any deviation or change not indicated in writing by the Contractor should automatically invalidate PREPA's seal of approval for that particular document.

- K. All work performed under these Specifications shall be done in a safe and workmanlike manner and in strict conformance with all local rules regulations and ordinances, etc. The Contractor shall use all necessary safety equipment, such as reflected jackets, safety cones, and safety warnings at the work site near road areas and vehicle traffic.
- L. All proposals must be completed in the prescribed format for the purpose of basic comparison and evaluation. Additional or separate data, however, which each Bidder may wish to present for clarification or amendment will be accepted without prejudice to the basic proposal, and will be considered in its applicable context.
- M. It shall be the Bidder's singular and sole responsibility to visit the job-site and to acquire whatever data is necessary for preparation of his/her Bidder's proposal, to meet the obligations and warranties to the Authority, as detailed in these Specifications. This activity shall be accomplished at the Bidders own initiative, time and expense, and at no charge or expense to the Authority. Prior to submitting a proposal, the Contractor informs himself of all local conditions which might affect his performance of the work. Such conditions shall include, but are not limited to: site operation schemes and procedures, workmen's facilities, location of central points, access to the site, available utilities, and disposal areas of excavated materials, uncertainty of weather (including historic weather data), and all other contingencies.

1.6 TEMPORARY FACILITIES

- A. Contractor's Field Office
 - a) The Contractor's field office shall be of such construction as approved by the Engineer. A temporary telephone shall be installed and maintained during the extent of the construction time by the Contractor. The Authority shall issue orders and directions to the Contractor at this field office.
 - b) The location of the construction offices and the preparation of the general area will be as specified by the Engineer.
 - c) The Contractor shall maintain proper communication between his field office and his field personnel. Failure to maintain said communication shall be considered just cause to withhold any or all payments due to the Contractor until said communications are restored.

B. Light and Power

- a) The Contractor shall furnish and install immediately upon the start of the work and shall maintain for the duration of the construction period, adequate temporary light and electric power as required, for his own use and for the use of all trades, subcontractors, and separate contractors, in connection with the work. This installation shall be made in accordance with the National Electrical Code and as directed by the Engineer.
- b) The Contractor shall provide at his expense for all electric power consumed for the illumination, power testing of all equipment, and other fringe expenses and service charges.

C. Sanitary Conveniences

- a) The Contractor shall provide temporary sanitary conveniences for use of the Contractor's employees and the employees of all trades, subcontractors, and separate contractors at the site and maintain them in a sanitary condition until the completion of the work. Said facilities shall meet the approval of the Puerto Rico Board of Health.

D. Water

- a) The Contractor shall make the necessary arrangements and provide all water required during the entire construction period. The cost for temporary water shall be borne by the Contractor, except for that used in the hydrostatic test. Also shall prevent the use of water for cleaning purposes. The uses of dry cleaning techniques (absorbents wipe and vacuum) are necessary for the pollution potential of the NPDES discharges. This is a BMPP requirement.
- b) Under any circumstance the liquids will be discharge to the ground. This includes purge lines before any repair. There will not be any discharge of chemical products and hydrocarbons to the discharge system, not to cause any deviation to the NPDES permit.

E. Scaffolds, Staging, and Safety Devices

- a) The Contractor shall provide, erect, maintain, and remove when directed, all scaffolding, staging platforms, temporary turn ways, temporary flooring, guard railings, stairs, etc., as required by local and state codes, or laws, for the protection of workmen and the public.

- b) The construction, inspection, and maintenance of the above items shall comply with all safety codes and regulations as applicable to the project.

F. Access to Facilities

- a) Maintain at all times all access roads to the project reasonably free of accumulated mud and/or debris. Special note must be taken to the fact of little space availability. The Contractor shall note this and program his site activities accordingly. Additional space if need will be provided by the Contractor at his cost in other facilities.

1.7 STANDARDS FOR EQUIPMENT AND MATERIALS

- A. All materials and equipment described or found necessary for the installation shall be new, free from defects, and shall be listed by Underwriters Laboratories, Inc., and by the American Water Works Association as conforming to their standards in every case where such standard has been established for the particular type of material in question. The Engineer shall approve all materials and equipment.
- B. Equipment and materials shall be properly stored, protected and carefully handled, following the manufacturer's recommendations, to prevent damage before and during installation. Damaged or defective items shall be replaced at no cost to PREPA.
- C. Any equipment, material or work performed without the Engineer's approval or in disagreement with the drawings, specifications or the contract, may be rejected. The Contractor shall replace or repair rejected equipment or labor at his expense as recommended by the Engineer.
- D. The Contractor shall furnish the services of an experienced licensed Engineer who shall constantly be in charge of the work together with skilled workmen, fitters, helpers, and labor required to properly unload, transfer, erect, connect, adjust, start, operate, and test the system. Work shall be performed in a workmanlike manner, shall present a neat and mechanical appearance when completed, and shall be subject to the approval of the PREPA.
- E. Materials or equipment to be supplied by the Contractor shall be subject to the approval of the Engineer. Valves and piping shall be from U.S. Manufacturers.

1.8 PROGRESS REPORTS

- A. Contractor shall submit to the Engineer a monthly progress report with the following information:
 - a) Dates of completion for activities that have been completed since the last report.
 - b) Days remaining for in-progress activities.
 - c) Changes to reflect variations from or modifications to the original network plan.
 - d) Project progress evaluation with identification of problem areas.
 - e) Recent photographs showing the work in progress.
- B. At least once a month the PREPA will compare the progress information with the Master Schedule. He will present the results at a progress review meeting with the Contractor, with identification of problem areas, if any.
- C. Contractor shall submit to the Engineer his purchase order numbers, dates, description of the materials involved, and the delivery dates specified. Such information is to be submitted at monthly intervals so that the Engineer will be cognizant of the progress being made by the Contractor in the placing of orders.

1.9 TECHNICAL APPROACH [**DO NOT APPLY FOR THIS CONTRACT**]

1.10 FORCE ACCOUNT

If the Engineer and Contractor are unable to negotiate a price for any Changes and/or Extra Work in accordance with ARTICLE 10 Changes and/or Extra Work of the TERMS AND CONDITIONS the Engineer may direct the Contractor to perform all or part of the revised Work on a force account basis. When the Engineer directs the Contractor to perform revised Work on a force account basis, PREPA will pay the Contractor as specified hereon:

A. Labor

PREPA will compensate the Contractor for labor at the actual rate of wage paid and shown on the payroll for every hour that the labor and foreman are actually engaged in the revised Work, plus an additional 15 percent for field and home office overhead costs and profit.

The foreman must be in direct charge of the specific operations and must be at the Project Site in order to be included in this compensation. Unless already included in the wage rates paid, the Contractor will also receive the actual labor-related costs incurred by reason of subsistence and travel allowances, health and welfare benefits, pension fund, or other fringe benefits, provided those payments are required by collective bargaining agreement or other employment contract generally applicable to the classes of labor employed on the Work.

The Department will prorate the wages of any foreman who is employed partly on the revised Work and partly on other Work. The Department will determine the prorated wage based on the number of workers employed on each class of Work as shown by the payrolls. The Department will prorate any subsistence or travel allowances paid to the foreman on the same basis as the prorated direct wages.

B. Materials

PREPA will pay the Contractor the actual cost of acceptable Materials delivered and used in the revised Work, including transportation charges paid by the Contractor (exclusive of equipment rentals), plus an additional 15 percent for field and home office overhead costs and profit.

C. Equipment

PREPA will pay the Contractor for Equipment at the rental rates agreed by both parties and effective on the date the two parties execute the force account agreement. This compensation is for Equipment, fuel, and lubricants, transportation that the Engineer authorizes and the Contractor uses on the Project, plus an additional 15 percent for field and home office overhead costs and profit. PREPA will not pay for small tools. PREPA will pay for the actual time the Equipment is in operation on the revised Work, plus travel time or transportation allowances.

If the Equipment is moved to and from the location of the revised Work under its own power by PREPA's request, PREPA will pay for the travel time at the above rental rates.

1.11 DELIVERY, HANDLING AND STORAGE

- A. Products will be delivered to the project, properly identified with name, type, and other necessary information for its identification.

- B. Contractor will be responsible for the delivery, unloading, storage and handling of the materials or equipment to be used in the project, and maintaining them in optimal conditions.
- C. Materials will be stored in an adequate area that satisfies the Engineer. The storage area will remain clean, in optimal conditions and free of hazards.
- D. Contractor will coordinate site storage and rubbish disposal areas with the Engineer.
- E. Equipment will be packed in suitable crates and boxes. Straps will be provided for full protection of equipment from damage during transit.
- F. Protect stored pipes, fittings, flanges and valves from moisture and dirt by covering with durable, waterproofing tarpaulins if necessary.

1.12 SAFETY PROVISIONS

- A. The Contractor shall comply with the following minimum requirements of a health and safety program:
 - a) The plan shall have its own loss control program.
 - b) It shall include an accident or incident investigation procedure.
 - c) It will describe procedures for compliance with requirements of all applicable regulations included in the 29 CFR. The Program latest revision date shall not be greater than a year from the projects commencement date.
- B. The PREPA's auditing committee shall approve the program, as a requirement to be included in the Evaluated Suppliers Registry.
- C. Plan shall include the following:
 - a) Plan shall include contingency procedures that include how to proceed in an emergency situation, during an accident, in case of an atmospheric disturbance, in case of fire and spill.
 - b) Copy of all training certificates, licenses or certifications required, according to the scope of work. For example: pesticide applicator, electrician, spill responder, refrigeration technician, DOT training for hazardous substances, etc.

- c) Copy of the Material Safety Data Sheets (MSDS) of all chemical products to be used during the project, for evaluation and approval by the Occupational Safety and Health Office at PREPA (Hazard Communication Section). All chemical products must be approved by PREPA.
- D. Services including the application of chemical products within closed spaces, like buildings, will be offered between Monday and Saturday AFTER PREPA's WORKING HOURS. The Contractor will take all steps necessary to assure the area will be free of nuisance odors or vapors before PREPA personnel is to reoccupy. All these will be done in coordination with the local supervisor of PREPA. Services in exterior parts of PREPA can be done during regular working hours.
- E. The Contractor shall assure that all wastes are removed and properly disposed of, in accordance with all applicable laws and regulations, after completion of work. Any remaining construction material shall be removed from PREPA facilities within 24 hours. If the contractor not able to dispose of the materials it shall move to an area protected from the elements.
- F. Before commencement of work, the Contractor shall take part in a coordination meeting with a Safety Officer, an Environmental Control Supervisor and the project manager on PREPA's behalf. During this meeting the site-specific work plan will be discussed and reviewed, including the safety rules and the environmental protection procedures to be followed. Also, a tour of the areas to be worked on will take place.
- G. All chemical products to be used shall be classified as Approval or Conditionally Approval by PREPA's Substances and Waste Management Department and Hazard Communication Section.
- H. Welding operations will comply with the requirements of OSHA, ANSI and NFPA.
- I. If the project involves the handling of non-asbestos insulation or other dust generating materials, like gypsum board, steps shall be taken to prevent the release of the dust to adjacent areas.
- J. The Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to, all employees on the work and all other persons who may be affected. Also to the work, property, material and equipment on or off the site, under the care, custody or control of the Contractor or any of his subcontractors.

- K. The Contractor shall comply with all applicable laws, ordinances, rules, regulations and lawful orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. He shall erect and maintain, as required by existing conditions and progress of the work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.
- L. The Contractor shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents, who shall develop and coordinate with the Safety Officer a safety program. This person shall be designated to execute only this duty. He also has the responsibility of conduct and take record of the weekly security meetings with the Contractor's employees involved in the required works and to report all accidents or incidents occurred during the project duration.
- M. Compliance with all safety provisions by subcontractors shall be the responsibility of the Contractor.
- N. Contractor agrees that it shall perform all work in compliance with federal, state and local occupational safety and health regulations, including but not limiting to hazard communication, and right-to-know laws. In addition, the Contractor agrees to observe the compliance of all precautions stated upon the applicable materials safety data sheets and container labels of all chemicals used in the contracted work.
- O. Contractor will obtain and maintain, during the duration of the contract, the proper permits from all federal, state and local regulatory authorities or other applicable government agency with respect to discharge, disposal, use, storage, handling and transportation of hazardous chemicals and substances as and when applicable law or regulation requires. For projects including the handling of asbestos, lead, or spilled hazardous substances, the notification to EPA or the EQB will be done by the Contractor, but in coordination with the following PREPA personnel: Safety Officer, Environmental Control Supervisor and the Substance and Waste Management Department.
- P. Contractor will not cause or permit any hazardous chemical or product containing a hazardous chemical to be at, or in the vicinity of, any place where any employee, agent, or contractor of Puerto Rico Electric Power Authority, or any employee of any such agent or Contractor, may be at risk or exposed to hazard as a result thereof during normal use or any foreseeable emergency.
- Q. Contractor will defend, indemnify and hold harmless, Puerto Rico Electric

Power Authority, its employees, agents or assigns for any and all direct liabilities and expenses arising out of noncompliance with safety provision clauses, irrespective of any other terms of this agreement.

- R. Puerto Rico Electric Power Authority may unilaterally terminate this contract upon Contractor's nonobservance of any of the foregoing or for any failure to comply with any of the safety provisions on this Contract upon thirty (30) days of a written notice to Contractor.

1.13 ENVIRONMENTAL PROTECTION CONDITIONS

- A. The Contractor shall exercise every reasonable precaution throughout the life of the project to prevent silting of rivers, streams, sea, ocean, lakes and reservoirs. Construction of drainage facilities as well as performance of other contract work, which will contribute to the control of settlements, shall be carried out in conjunction with earthwork operations or as soon thereafter as is practicable.
- B. Unless otherwise approved in writing by the Engineer, construction operations in rivers, streams, lakes and reservoirs shall be restricted to those areas where channel changes are shown on the plans and to those areas that must be entered for the construction of temporary or permanent structures. Rivers, streams, lakes and reservoirs shall be promptly cleared of all false work, piling, debris, or other obstructions placed therein or caused by the construction operations. Frequent fording or live streams with construction equipment will not be permitted. Temporary bridges or other structures shall be used wherever an appreciable number of stream crossings are necessary.
- C. Unless otherwise approved in writing by the Engineer, mechanized equipment shall not be operated in live streams except as may be required to construct channel and temporary or permanent structures. The Contractor shall exercise every reasonable precaution throughout the life of the project to prevent pollution of rivers, sea or ocean streams, lakes or reservoirs.
- D. Pollutants, such as chemicals, fuels, lubricants, bitumen, raw, sewage and other harmful waste shall not be discharged into or alongside of rivers, streams, seas, oceans, lakes or reservoirs or into natural or manmade channels leading thereto. The Contractor shall also comply with the applicable regulations relating to the prevention and abatement of water, air and noise pollution among others. The Contractor shall be liable for any fines imposed to PREPA due to the Contractor's noncompliance with any federal or local environmental regulation.

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- E. The Contractor agrees to indemnify PREPA for all direct liabilities and expenses arising out of any claim due to an environmental violation, caused by his enterprises during the performance of the contract or by nonperformance of its obligations under the contract.
- F. The Contractor should have available, close to the working area, the necessary equipment to control and pick up any spilling that could occur, during the performance of the work required by the contract. The equipment should include the necessary for the waste disposal.
- G. All equipment to be used in the work area should be free of oil, transmission fluid or hydraulic fluid leakage. If the equipment develops a leakage during the work process, it should be repaired out of the PREPA site or replace immediately.
- H. The Contractor should dispose of all garbage generated because of this work, according to the environmental regulations. The use of PREPA's garbage disposal equipment is not permitted. The removed materials shall be disposed as soon as possible (less than 24 hrs.) in order to avoid exposed materials at open areas. If the materials can't be disposed immediately, the Contractor shall move the materials to a contained and non-exposure area.
- I. Any Chemical product to be used shall be classified Approved by PREPA's Hazard Communications Section before entering the work area of PREPA's premises.
- J. The Contractor shall protect all chemical products to be used against rain or any other weather conditions. Prior to the use of any chemical product, the United States Environmental Protection Agency (USEPA), has to approve the discharge of any toxic substance under the NPDES Permit for each facility. Discharge of any product under the Federal Insecticide, fungicide and Rodenticide Act is prohibited unless specifically authorized under the NPDES Permit. The assistance includes, and is not limited to, any information regarding the process, products and technical issues under EPA's evaluation.
- K. The Contractor shall avoid contaminating air, soil or water with chemical substances or waste material generated because of his work.
- L. As a part of best management practice, the Contractor shall avoid the use of water for cleaning purposes. The use of dry cleaning techniques (absorbents or vacuum cleaning) is necessary to avoid the potential contamination of the NPDES discharges. Also follow the section 12.0 of the Storm Water

Pollution Prevention plan (SWPPP) for San Juan Power Plant. The SWPPP is a requirement of NPDES permit.

- M. All chemical analysis shall be performed by a laboratory included in PREPA's Material Management Division Supplier's Register as companies properly qualified and evaluated by PREPA's Quality Assurance Department to perform this type of work. Prepa's personnel will audit the sampling and disposal of waste material.
- N. "The disposal of hazardous waste material (if any) shall be done in a PREPA approved Treatment, Storage, Disposal Facility (TSDF).
- O. The Contractor shall comply with all environmental laws and regulations related to water, soil and air quality.
- P. The Contractor shall comply with all arrangements established in the Consent Decree between PREPA and Environmental Protection Agency.
- Q. All work shall be performed according to the Storm Water Pollution Prevention plan (SWPPP) for San Juan Power Plant, which is part of the Special Conditions of the NPDES permit.
- R. The Contractor will be held responsible for any NPDES violations and its related costs if the violations are related to the Contractor's activities.
- S. The Contractor shall submit evidence of compliance with 49 CFR 172 Subpart H (DOT).
- T. All work shall be performed according to Section 13 of the Storm Water Pollution Prevention Plan (SWPPP) for San Juan Power Plant. (Section 13.0 - Contractor Practices and Procedures), included as follows:
 - a) Contractors are potential sources of contamination in storm-water and process wastewater because of the wide variety of materials used and the non-routine nature of their work. However, contractors must adhere to the PREPA policies regarding maintenance practices, operations practice, good housekeeping, training, materials compatibility, condition of equipment, and materials handling.
 - b) A routine part of a Contractor's is SWPP training. Each Contractor must confirm that its employees are properly trained in environmental and safety principles and pertinent plant policies. Non adherence to these policies can result in dismissal of a Contractors employee or the entire Contractor Company.

- c) Specific controls on Contractor activities include:
- SWPPP training at Contractor orientation.
 - Documentation of materials brought on site by the Contractor. Contractor must identify materials and amounts in their working plans. Also, Contractor must remove all unused material from the site at the completion of the project.
 - Contractor's equipment must be in good working order. Equipment with broken or defective parts or oil leaks will not be allowed on site.
- U. It is necessary to avoid the development of a new storm-water discharge point as a consequence of the construction activities. These activities shall not cause any violations to the NPDES Permit Discharges.
- V. The Contractor shall submit, for evaluation by the Environmental Control Supervisor, a copy of a Site Specific Work Plan. The Plan shall include any other regulation or guideline applicable to the scope of work, and shall include a contingency plan which includes how to proceed in an emergency situation, such as: an accident, an atmospheric disturbance, hazardous chemical substance spill, a fire and others.
- W. The Contractor shall inform and coordinate with the Environmental Control Supervisor of any work to be done to avoid any environmental violation.
- X. Before starting the work, the Contractor shall submit, for evaluation by the Environmental Protection and Quality Assurance Division, a copy of a Site Specific Work Plan.
- Y. The Contractor, upon completion of the work, must leave all work areas clean, organized and free of contaminants, according to the laboratory analysis, before and after the work. The storage area for the removed equipments and parts must be appropriate to avoid contaminants dispersion to the ground or water.
- Z. Temporary areas of construction and disposal materials shall be areas protected with dikes. In the absence of dikes, the Contractor shall prepare temporary areas with dikes to avoid materials exposure.
- AA. When using portalettes, the Contractor is responsible for the location of these in diked protected areas to prevent and avoid any sanitary discharge thru the

power plant premises. It is prohibited to clean or wash the portalettes within the power plant premises.

PART 2 PRODUCTS

- A. All products in this project shall be approved by PREPA prior entrance to the property.
- B. Whenever in these specifications there are listed specific brands and models of products, it will be understood as equal or approved equal to said products. A five days' period after the order to proceed will be allow for the contractor to submit alternate products, beyond this period the contractor shall provide the approved models.
- C. Steel and coating material shall be produced in the USA.

PART 3 EXECUTION

3.1 REQUIRED WORK

- A. The required works will be based on the global cost of the project. These will be coordinated and integrated to obtain a uniform job stream. The works required the rehabilitation of the Fuel Oil #6 Service Tank S-10.
- B. New anchors design calculation shall be performed using API-650 latest edition and using a Seismic Use Group III (SUG III), Importance factor (I) of 1.5. Contractor shall include the installation of any additional anchor based on the calculation results.
- C. Repair undercut (0.250") at the internal manual level pipe support as per API-653 section 9.6. Refer to Annex 3 – Tank Inspection Report, section 4.3 and bottom right picture on page 35.
- D. Repair bottom plate #4 with a 24" x 12" welded on plate as per API-653 section 9.3. Refer to Annex 3 – Tank Inspection Report, section 4.6 and bottom right picture on page 39.
- E. Repair undercut (0.500") at nozzles N3 (4"Ø) as per API-653 section 9.6. Refer to Annex 3 – Tank Inspection Report, section 4.7 and top right picture on page 34.
- F. Replace ten (10) stairway steps identical to the existing ones.
- G. Replace twenty (20) stairway steps support bars identical to the existing

ones.

- H. Replace the stairs top landing platform.
- I. Replace the two roof nozzle flanges located adjacent to the top platform and also their corresponding mate flanges. All gaskets, bolts, nuts and washers shall be replaced.
- J. Replace the existing illumination system including wiring, conduit, poles and luminaires.
 - a) Conduits shall be PVC coated galvanized steel. Approved model Plasti-Bond REDH2OT.
 - b) Pole shall be hot dipped galvanized.
 - c) Luminaries (3) shall be high power LED explosion proof for pole mounted application. All luminaries shall have an output of 16,000 lumens. Product shall be certified and wear IP66, Ex, ATEX, RoHS and CE markings. Applicable for gas explosion zone 1, zone 2 and zone 21, zone 22 dust explosion. Rated frequency of 60 Hz and input voltage 90-305 VAC. Approved model Tormin BC9700-L150.
- K. Provide a new tank reconstruction nameplate in accordance with API-653 section 13.1
- L. Install a new float and tape transmitter for tank level measuring. Approved model: Varec 2920 FTT with HART communication protocol.
- M. Install a new liquid level indicator (target and gauge board). Approved model Varec 6700 Liquid Level Indicator.
- N. Scope shall include the installation of 10 (12" x 12") insert plates for roof or shell repairs, total of 10 ft² of repair plate area. Bidders shall include unit price for these repair plates for additive/deductive.
- O. Scope shall include the installation of 10 (12" x 12") lap patches for bottom repairs, total of 10 ft² of repair plate area. Bidders shall include unit price for these repair plates for additive/deductive.
- P. Scope of work shall include 20 linear feet of shell to bottom weld repair (or any butt weld) and 20 linear feet of bottom weld repair (or any fillet weld). Bidders shall include unit price for these repair welds for additive/deductive.

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- Q. All flanges shall be refitted with new gaskets, bolts, nuts and washers.
- R. After coating removal all bottom and shell to bottom welds shall be vacuum tested.
- S. All telltale holes shall be cleaned and pneumatically tested.
- T. All scaffolding shall be inspected, certify and tagged with the corresponding labels.
- U. Grit blast media (black beauty) used to remove the existing coating shall not be recycled for final surface profile preparation to avoid surface contamination. Recycle material shall be pass thru a screening device and heated to remove any humidity. The contractor shall be responsible to avoid this situation using its preferable method. In most cases the surface can be prepare as final with only one pass of grit blasting. PREPA does not require two separate grit blasting, if surface conditions are met with one pass.
- V. All coating products shall be applied using a single or plural component airless system. Brushes and rollers will ONLY be used for initial stripe coat of all seams, corners and all the top weir channels.
- W. Construction and consolidated permits will be required for this project.
- X. The Contractor shall be responsible for the removal and disposal of the sand or media used for the blasting of the tank's interior and exterior surfaces. This material (blasting media) must be Non-Hazardous.
- Y. The Contractor/Subcontractor must be certified on the use or application of the specified coating systems. The Contractor must present an original certification signed by the coating manufacturer or official local representative stating that the employees performing the mixing and application of the coating systems were formally instructed in such procedures, specifically in the product used. Local firms shall present a current letter of representation from the manufacturer.
- Z. Besides the coating work on the tank interior and exterior shell, the Contractor shall paint up to the next flange face and all welded support structure. Railings, gratings and stairs shall also be included as part of this scope of work.
- AA. Stripe coat requirement for paint layers:
 - a) Interior surfaces – Only before primer coat

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- b) Exterior surfaces – Before each coat
- BB. Lead content is not expected in the existing coatings of the Fuel Oil #6 Service Tank S-10.
- CC. Cleaning
 - a) The tank shall be subjected to a pressured water cleaning (5,000 psi minimum) using a solution of potable water and Chlor-Rid in a dilution of 1:100. This procedure shall be applied to all internal and external surfaces of the tank.
 - b) Surfaces shall be tested for contaminants before any rehabilitation or surface preparation. Cleaning as described in the preceding item shall be repeated if contamination levels are founded to be greater than the followings:
 - i. Chlorides > 20 mg/m² (2 µg/cm²)
 - ii. Sulfates > 20 mg/m² (2.5 µg/cm²)
 - iii. Nitrates > 25 mg/m² (2.5 µg/cm²)
- DD. Final Surface Preparation (Refer to Specification 09900)
 - a) Interior – Surface Preparation #1, white metal (SSPC-SP5).
 - b) Exterior – Surface Preparation #2, near white (SSPC-SP10). **Requires 100% tank encapsulation.**
- EE. Coating, Lining and Repair System (Refer to Specification 09900)
 - a) Interior (100% of Surfaces) - Coating System 4
 - b) Exterior (100% of Surfaces) - Coating System 1
- FF. Tank bottom to concrete base edge shall be sealed with *Sikaflex-1a* polyurethane elastomeric sealant.
- GG. Contractor shall prepare test coupons as part of the quality control program. These coupons shall be prepared during initial, intermediate and final stages of the Work. PREPA will require 3 coupons for interior and 3 for exterior. Each coupon shall reflect all stages of the coating process. PREPA will use these coupons for pull-off (adhesion) testing. Coupons material shall be carbon steel with a 12" x 12" x ¼" size. A PREPA's inspector shall witness test coupon preparation process.

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- HH. The ID Plate shall be smooth satin matte finish Aluminum 5052 or 6061, with 1/8" thickness and engraved lettering. Other acceptable material will be Stainless Steel 304 or 316.
- II. All interior surfaces (100%) shall be subject to a High Voltage Holiday Spark Test.
- JJ. Contractor shall keep record of the following information (Contractor could use the provided drawings of the tank for this requirement):
- a) Coating production batches and the location where it was applied.
 - b) Name of the painter and personnel in charge of the mixing.
 - c) Date, weather conditions and substrate conditions.
 - d) Surface profile.
 - e) Application Method.
 - f) Coating thickness (WFT & DFT)
- KK. Surface profile tests shall be performed with a digital gauge similar to Elcometer 224.
- LL. Manual version of the PosiTest AT-M will be allowed for adhesion testing.
- MM. The Contractor is not required to have a NACE inspector on-site for the project duration. Nevertheless, a weekly report from a NACE inspector during surface preparation and coating application period shall be delivered to PREPA on every construction meeting with the PREPA's project manager.
- NN. Contractor shall prepare and install an identification plate (24" x 24") with the following information:

DATE: CONTRATOR: PREPA PO:

INTERIOR COATING:

SURFACE PREPARATION:
PRIMER:
BASE:
FINISH:

PROFILE:
THICKNESS (DFT):
THICKNESS (DFT):
THICKNESS (DFT):

EXTERIOR COATING:

SURFACE PREPARATION:

PRIMER:

BASE:

FINISH:

PROFILE:

THICKNESS (DFT):

THICKNESS (DFT):

THICKNESS (DFT):

OO. Colors

a) Interior

i. Base: Red

ii. Finish: Gray

b) Exterior

i. Primer: Green

ii. Base: Aluminum Grey

iii. Finish: White

PP. Contractor shall follow Annex 1 for tank identification.

QQ. Contractor shall follow Annex 2 for tank grounding.

RR. Contractor shall follow the requirements of API 650, section 7.3.6 (Hydrostatic Testing Requirements).

SS. Water connection for the hydrostatic test will be approximately 150 ft. from the tank.

TT. The filling rate will be 45,000 gallons per 8 hr. shift. PREPA will allow filling the tank only 1 shift per day (regular shift).

UU. The discharge location for the hydrostatic test water should be approximately 150 ft away.

VV. Contractor shall consider 7 labor days to perform water analysis and to drain the tank.

WW. Contractor shall be responsible to clean the tank before hydrostatic test to avoid water contamination (oil and grease).

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- XX. Contractor's Project Engineer (with the require certifications) could serves as safety officer if is present all the time. Otherwise, Project Engineer shall be available to visit the project site at any time during the project and shall visit and supervise the works at least three times a week (8hrs each day). If a non -resident Project Engineer scheme will be use then a separate fulltime Safety Officer shall be provided. Contractor shall assure the presence of a qualified person at the site throughout the project duration.
- YY. Bidders shall consider the application methods established in the specifications for their proposals.
- ZZ. Final tank inspection report is included as Annex #3.

END OF SECTION 15010

SECTION 09900
PAINT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings of the Puerto Rico Electric Power Authority ("The Authority"), general provisions and special conditions.
- B. Whenever in these specifications there are listed specific brands and models of products, it will be understood as equal or approved equal to said products.

1.2 SUMMARY

- A. This section includes the methods and requirements for surfaces preparation and painting.
- B. All exposed surfaces shall be painted, with the exception of those specified. Surfaces that are not mentioned specifically will be painted equal to the adjacent surfaces that are similar. If the finished color has not been designated, the Engineer will select the standard color or available finished.
- C. For tanks application the following areas of the interior shall be painted to a 100% of the surface: bottom, roof, columns, rafters, beams, shell and columns support component. Tank exterior shall be coated entirely. This shall include manholes, manholes' flanged covers, reinforcing plates, anchors plates, anchors bolts and pipe supports.
- D. That equipment that will not be painted includes the parts that have movement, like the equipment that are mentioned ahead and the lights.
 - 1. Valves
 - 2. Fans and Axes of Motors
 - 3. Sensors
- E. Labels or Name Plates – All labels, name plates, UL and Factory Mutual labels or any kind of identification shall not be painted.
- F. The contractor is responsible in providing all required equipment to make the work, including scaffolds, stairs, etc. The removal of this equipment is

require once is finished the work. Contractor shall provide all required labor, supervision, materials and quality control specialist.

1.3 DEFINITION

- A. Paints: coating system (base, intermediate, finished), primers, sealants, enamels, epoxies.

1.4 REQUIRED DOCUMENTS

- A. Product Literature: Manufacturer's technical data and instructions of paints to be used.
 - 1. The paintings will be identified with the number and identification name of the manufacturer.
- B. Samples for verification: Contractor shall provide samples with each color and material to be applied on representative samples of the present substratum. Each layer shall be defined. Representative colors shall be used when samples for revision are prepared.
- C. The contractor shall submit the specific work plan for PREPA's approval before mobilization. This plan shall include the propose coating activities and schedule for delivery of products, equipment and materials.
- D. In case of using different products from those specified, the bidders will include in their proposal the technical information of the new product and its Material Data Sheets (MSDS, by its abbreviations in English) for evaluation and approval.

1.5 QUALITY ASSURANCE

- A. Responsibility of a single source: To provide the layer for bases, intermediate and final coat, and mixing agents of the same manufacturer.
- B. The Contractor's personnel shall be formally trained in the preparation, handling and application of the supplied products by the coating manufacturer. Written notification of such training shall be transmitted to PREPA's project manager.
- C. Work Coordination: Revised other sections where the base layer is shop applied to guarantee system compatibility.

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1. The Engineer shall be notified of any anticipated problems when using the specified materials.
- D. Material Quality: Provide the manufacturer's best quality paint equal or similar to those specified.
 1. Names used for colors or materials designated by the manufacturer, do not imply that other equivalent products of other manufacturers are excluded.

1.6 GENERAL REQUIREMENT

- A. All work related with this specification shall be performed by experience personnel in accordance with the latest edition of the recommended practices by:
 1. NACE
 2. SSPC
 3. EPA
 4. OSHA
 5. ASTM
 6. ISO
 7. Local and federal agencies
- B. Contractor or sub-contractor shall be certified by the coating manufacturer as an applicator
- C. Works with toxic materials shall be done following the actual applicable EPA and OSHA regulations.
- D. The Contractor shall coordinate with the Engineer the use of electricity and water of the Power station, necessary to make the work. Any electrical devices or water to the working area is Contractor's responsibility.
- E. The Contractor will provide and require to all his personnel the use of security equipment required by: OSHA, the Engineer or any other agency that have jurisdiction, when making the required works in this Specification.
- F. All material or work done by the Contractor that differs from the drawings, specifications or contract can be rejected by the Engineer. Cost associated for replacement is at Contractor's responsibility.

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- G. It is Contractor's responsibility to certify that the documents for approval does not constitute deviation or changes to the specifications of the contract. Any deviation or change to the specifications of the contract, not certified in writing by the contractor, disabled automatically Authority's seal of approval applied to any document related to this deviation or change.
- H. All chemical products shall be approved or conditionally approved by PREPA.
- I. Contractor shall be responsible for calculation of working area to determine products quantities.

1.7 DELIVERY, HANDLING AND STORAGE

- A. All materials, parts and equipment shall be delivered at project site in its originals manufacturer's packaging, factory sealed and labeled with the following information:
 - 1. Name of the product.
 - 2. Description of the product (generic classification).
 - 3. Number of the general specification, whenever apply.
 - 4. Manufacturer's warehouse number and fabrication date.
 - 5. Volume content.
 - 6. Paints' mixing instructions.
 - 7. Paints' application instructions.
 - 8. Paints' number and color name.
 - 9. MSDS
- B. Contractor shall be responsible for the delivery, unpacking, storage, custody and manage of all materials and equipment for the job.
- C. Instructions to follow:

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1. Storage unused materials in its original package in a dry, closed, ventilated area, following manufacturer's storage recommendations.
 2. Keep packages in use in optimal conditions, free from residuals and unrelated storage materials.
 3. Keep storage area ordered and clean. Wastes removal shall be daily. The Contractor is responsible for the disposal in an adequate and authorized landfill.
 4. Follow any necessary measure to assure the safety of workers and working areas against fire and health hazards, wrong handling during paint mixtures and applications.
- D. The available source of electric energy for the Contractor at the project site is 120/208 VAC y 480 VAC, 3Ø. It is bidder's responsibility to verify connection point during pre-bid meeting.

1.8 Working Conditions

- A. To prevent quick drying, bulges, runny paint, and fast solvent evaporation, where is hazardous in a confined space, surfaces with a temperature over 100° F shall not be painted.
- B. To ensure the preceding item, bidders shall visit the job site to verify the working conditions. Their proposals shall include an isolation system (plastic bubble) for exterior surfaces during surface preparation and coating application. For interior surfaces an air conditioning system shall be included in the proposal in case that required conditions (temperature and humidity) are not met during working hours (7:00 a.m. to 5:00 p.m.) or working days.
- C. Painting in a rainy day is not permitted.

PART 2 PRODUCT

2.1 GENERAL

- A. All products shall be approved by PREPA before entering the premises.
- B. The volatile organic compound content of the products to be used shall be less than 3.5 lbs/gal (420 g/l).

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- C. Some of the products indicated in section 2.2 shall be re-evaluated in the “Oficina de Comunicación de Riesgos” if original evaluation was before 1998.
- D. ONLY PREPA WILL DETERMINE IF THE ALTERNATE PRODUCT CAN BE CONSIDERED AS EQUAL OR APPROVED EQUAL.
- E. Alternate product shall comply with the following conditions:
 - 1. Same chemical and physical composition, including additives such as anticorrosive pigments, flakes, aluminum, etc.
 - 2. Equal or greater solid content per volume.
 - 3. Similar curing characteristics.
 - 4. Equal or greater maximum dry temperature exposure.
 - 5. Equal or greater maximum submerged temperature exposure.
 - 6. Equal or lower functional cure time.
 - 7. Equal or lower full cure time.
 - 8. Equal or greater compressive strength under the same test conditions (ASTM D695).
 - 9. Equal or greater flexural strength under the same test conditions (ASTM D790).
 - 10. Equal or greater tensile strength under the same test conditions (ASTM D638).
 - 11. Equal or greater elongation capacity under the same test conditions (ASTM D638).
 - 12. Equal or greater adhesion capacity under the same test conditions (ASTM D4541).
 - 13. Equal or greater Shore D Harness under the same test conditions.
 - 14. Same system classification under ISO 12944 and NORSOK.

15. Equal or greater temperature range during application.

2.2 SYSTEMS

A. System 1: Coating system for steel surfaces on a severe environment.

1. Base – Three component, metallic zinc rich epoxy with a minimum of 70% solid content per volume. Approved product: **PPG AMERCOAT 68 HS.**
2. Intermediate – a two component, low VOC, high build, self-priming, surface tolerant, lamellar aluminum flakes reinforced, epoxy mastic with a minimum of 88% solid content per volume. Approved product: **PPG AMERLOCK 400 AL.**
3. Finish – Two component, high solids, low VOC, abrasion resistance, high gloss epoxy siloxane with a minimum of 90% solid content per volume. Approved product: **PPG PSX 700.**

B. System 2: Coating system for steel surfaces on a severe environment where a limited to good surface preparation is required and medium temperature (max 302 °F) exposure.

1. Base: Two components high build surface tolerant epoxy primer pigmented with aluminum and lamellar micaceous iron oxide and 80% solids by volume. Approved product: **INTERNATIONAL INTERPLUS 256.**
2. Intermediate: Two components high build surface tolerant epoxy maintenance coating pigmented with aluminum, NSF certification and 82% solids by volume. Approved product: **INTERNATIONAL INTERSEAL 670HS.**
3. Finish: Two components acrylic polyurethane with 68% solids by volume. Approved product: **INTERNATIONAL INTERTHANE 990HS.**

C. System 3: Lead removal system:

1. Approved product: **ENVIRO-PREP CHEMICAL STRIPPER 33073**

D. System 4: Coating system for fuel tank's interior.

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1. Primer: Low viscosity epoxy primer with 100% solid content per volume. Approved product: **INTERNATIONAL CEILCOTE 680 PRIMER.**
 2. Finish: Amine cured epoxy, moisture tolerant, flake reinforced, room temperature cured with 100% solid content per volume. Approved product: **INTERNATIONAL CEILCOTE 664 CEILGUARD**
- E. System 5: Coating system for water tank's interior:
1. Primer: Low viscosity epoxy primer with 100% solid content per volume. Approved product: **INTERNATIONAL CEILCOTE 680 PRIMER.**
 2. Base: Heavy duty tank lining with 100% solid content per volume. Approved product: **INTERNATIONAL INTERLINE 925.**
 3. Finish: Heavy duty tank lining with 100% solid content per volume. Approved product: **INTERNATIONAL INTERLINE 925.**
- F. System 6: Coating system for tank's interior where pH levels fluctuate (2-14 pH) with temperature up to 200°F :
1. Primer: Two component vinyl ester resin peroxide cured with 100% solid content per volume. Approved product: **KCC CORROSION CONTROL P3/P4 PRIMER.**

Alternate Approved Product: **CEILCOTE 370 HT**
 2. Base: Two component novolac vinyl ester resin, special flake filler, peroxide cured polymer system with 100% solid content per volume. Approved product: **KCC CORROSION CONTROL VE 42.**

Alternate Approved Product: **CEILCOTE 222 HT**
 3. Finish: Two component novolac vinyl ester resin, special flake filler, peroxide cured polymer system with 100% solid content per volume. Approved product: **KCC CORROSION CONTROL VE 42.**

Alternate Approved Product: **CEILCOTE 222 HT**
- G. System 7: Repair of Steel in Highly Erosive and Corrosive Submerge Service

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1. Filler and Base: Two component, bisphenol A resin with an aliphatic polyamine hardener, rebuilding putty reinforced with aluminum oxide and ceramics with a 100% solid content per volume. Approved product: **DUROMAR SAR CERAMIC PUTTY**.
 2. Finish: Two component, bisphenol A resin with a modified aliphatic polyamine hardener, lining reinforced with aluminum oxide and ceramics with a 100% solid content per volume. Approved product: **DUROMAR EAC CERAMIC LINING**.
- H. System 8: Repair of Steel in Highly Pitted and Deteriorated External Surfaces.
1. Filler and Base: Two component, bisphenol A resin with an aliphatic polyamine hardener, rebuilding putty reinforced with aluminum oxide and ceramics with a 100% solid content per volume. Approved product: **DUROMAR SAR CERAMIC PUTTY**.
 2. Intermediate: Two component, bisphenol A resin with a modified aliphatic polyamine hardener, lining reinforced with aluminum oxide and ceramics with a 100% solid content per volume. Approved product: **DUROMAR EAC CERAMIC LINING**.
 3. Finish: UV stable polyaspartic coating system with an aliphatic isocyanate, zero VOC and 100% solid content per volume. Approved product: **DUROMAR 5610**.
- I. System 9: Tanks bottom underside (shop applied):
1. Two component fast curing solvent based inorganic zinc rich ethyl silicate primer with a minimum 63% solid content per volume. Approved product: **INTERNATIONAL INTERZINC 22**.
- J. System 10: Concrete Repair and Lining System for Concrete Surfaces with Exposure to Chemicals and Heavy Traffic.
1. Sealer: Multifunctional epoxy with modified cycloaliphatic amine hardener concrete sealer, 100% solid content per volume. Approved product: **DUROMAR HPL-1301**.
 2. Rebuild Vertical and Horizontal Surfaces: Epoxy grout, 100% solid content per volume, mixed in a ratio of 60 lbs of aggregate (30 lbs of washed fine sand and 30 lbs of ¼" pea gravel) per gallon of

product for a concrete consistency. **Only** for heavy damaged areas and ultra-protection when specify. Approved product: **DUROMAR DUROFIL.**

3. Resurface Horizontal Surfaces: Two component epoxy novolac material, 100% solid content per volume, mixed in a ratio of 9.5 lbs of sand per gallon of product. Approved product: **DUROMAR CHEMECRETE SUPER.**
4. Lining: Two component novolac epoxy with modified cycloaliphatic amine hardener, 100% solid content per volume. Approved product: **DUROMAR DF-4301.**

K. System 11: Concrete Repair and Lining System for Concrete Surfaces with Exposure to Chemicals.

1. Sealer: Multifunctional epoxy with modified cycloaliphatic amine hardener concrete sealer, 100% solid content per volume. Approved product: **DUROMAR HPL-1301.**
2. Rebuild Vertical and Horizontal Surfaces: Epoxy grout, 100% solid content per volume, mixed in a ratio of 60 lbs of aggregate (30 lbs of washed fine sand and 30 lbs of ¼" pea gravel) per gallon of product for a concrete consistency. **Only** for heavy damaged areas and ultra-protection when specify. Approved product: **DUROMAR DUROFIL.**
3. Lining: Two component multifunctional novolac epoxy with modified cycloaliphatic amine hardener and reinforced with flake glass, 100% solid content per volume. Approved product: **DUROMAR HPL-4310 FG.**

L. System 12: Internal coating system for condensate tanks

1. Base: Multi-functional novolac epoxy coating with a modified cycloaliphatic amine hardener and reinforced with glass flakes, 100% solids content per volume. A submerge maximum temperature of 300°F and a pH range from 0.5 to 14. Approved product: **DUROMAR HPL-4310 FG.**
2. Finish: Multi-functional novolac epoxy coating with a modified cycloaliphatic amine hardener and reinforced with glass flakes, 100% solids content per volume. A submerge maximum

temperature of 300°F and a pH range from 0.5 to 14. Approved product: **DUROMAR HPL-4310 FG.**

PART 3 EXECUTION

3.1 PRELIMINARY

- A. The product's manufacturer Technician will examine the substrate and the conditions under which the work will be made to verify that all requirements and conditions are met before application. The Technician is the sole responsible to certified in written that such required conditions are properly met to begin application.
- B. All products shall be from the same manufacturer, including the cleaning thinner.
- C. The use of thinner in the coating mix is **prohibited**. Thinner shall only be used as a cleaning agent.
- D. Stripe coat shall be applied to all welds, edges and corners with a minimum dry film thickness (dft) of 5 mils. This thickness shall not be considered as part of the coating system layers.
- E. Coating application shall follow manufacturer recommendations and SSPC-PA1 standard.
- F. Contractor shall remove all weld spatter and slag to a smooth contour before abrasive surface preparation and coating.
- G. All surface preparation and coating application shall be performed at the site. Shop primer shall be removed at the site.
- H. Surface preparation shall be compare to photographic reference from SSPC-VIS 1 for steel, prepared with dry grit media blast.
- I. In the case that the overcoat window expired, contractor shall apply a dry grit media blast to a SSPC-SP7 (Brush-Off Blast Cleaning) with the specified anchor profile followed by a surface cleaning with a 98% Alcohol.

3.2 PREPARATION

- A. General Procedures: Remove or protect every accessory, plates, luminaries, or similar equipment not to be painted. All these equipment shall be reinstalled after completing the job.
- B. Before abrasive cleaning, wet or dry, evaluate for the presence of oil or grease on the surface to be painted. Oil and grease shall be completely removed by Solvent Cleaning, SSPC-SP1 or recommended by the manufacturer. Use one of the following test to detect the presence of oil or grease:
 - 1. Water breaking: Use atomizes distilled water on the surface. The presence of oil or grease is detected when the water does not penetrate.
 - 2. Clean Cloth: Slightly rug a clean white cloth over the surface. Discoloration on the cloth is an evidence of grease or oil.
- C. Surface preparation before painting/coating:
 - 1. Surface Preparation 1: Working area shall be isolated. Dry abrasive grit blasting to **white metal** (SSPC-SP5) with a surface profile of 3 mils, for surfaces exposed to severe environment. For working areas inside PREPA's facilities, sponge jet technology can be used with the same requirements.
 - 2. Surface Preparation 2: Working area shall be isolated. Dry abrasive grit blasting to **near white** (SSPC-SP10) with a surface profile of 2 mils, for surfaces exposed to severe environment. For working areas inside PREPA's facilities, sponge jet technology can be used with the same requirements.
 - 3. Surface Preparation 3: Horizontal or vertical vacuum abrasive cleaning to **commercial grade** (SSPC-SP6) for steel surfaces exposed to severe environment. The abrasive cleaning profile is 3 mils.
 - 4. Surface Preparation 4: Water pressurized (5,000psi) blast cleaning with inhibitors for surfaces exposed to severe environment. Areas with localized corrosion or with loosed material shall be cleaned with a motor with vacuum cleaning attachments

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5. Surface Preparation 5: Wet abrasive cleaning for surfaces exposed to severe environment. The abrasive cleaning profile is 2 mils.
 6. Surface Preparation 6: Sodium bicarbonate cleaning using inhibitors in water, for surfaces exposed to severe environment. The abrasive cleaning profile is 2 mils.
 7. Surface Preparation 7: For concrete substrates, medium shot-blast to ICRI CSP 4 or 5.
- D. Water, residual material used for cleaning, residuals painting, scales, or loose material as a result of the surface preparation shall be recollected for a full RCRA characterization test.
1. Residual collectors systems are Contractor's responsibility.
 2. It is prohibited to store residual materials at tanks dikes areas.
- E. Material Preparation: Mix and prepare the components following manufacturer's recommendations.
1. Keep clean and free of foreign materials the containments used for mixing and paint application.
 2. Only use solvents and mixing agents of the same manufacturer.
 3. Products diluted in excess are not allowed. The Contractor is the sole responsible on applying and ending with the specified thickness (dry). Engineer shall approve the required dry thickness applied.
- F. Procedure for Testing and Removal of Soluble Salts (Chloride/Sulfate/Nitrate) – Not necessary when the surfaces are water jetted cleaned. The methodology shall be used for tank's interior.
1. All surfaces shall be water blasted cleaned with a minimum of 3,000 psi, using a 1% solution of Chlor Rid or similar product to remove soluble salts after abrasive cleaning and to prevent deformations on the surface profile. The maximum chloride permissible contamination level in the water used for cleaning is limited to 100ppm.

2. The base coat (primer) can be applied if the surface is clean, free of dust, abrasive and other contaminants. The following tests shall be done to guarantee the cleanness of the surface:
 - a. Adhesive tape testing every 1,000 ft ².
3. Chlor Test CSN, or similar product, shall be done one hour after abrasive cleaning. The test shall be done on representative areas with corrosion or loosed material, and closed to weld seams at shells, roof and bottom.
4. Surfaces shall be tested for contaminants before any rehabilitation or surface preparation. Cleaning as described in the preceding items shall be repeated if contamination levels are founded to be greater than the followings
 - a. Chlorides > 2 ppm (2 µg/cm² or 20 mg/m²)
 - b. Sulfate > 2.5 ppm (2.5 µg/cm² or 25 mg/m²)
 - c. Nitrate > 5 ppm (5 µg/cm² or 50 mg/m²)

3.3 APLICATION

- A. Apply the coating following manufacturer's instructions. Use suitable techniques and equipment for the material to be applied on the substrate. The airless spray method is preferable. The Contractor shall take all necessary measures to prevent the intrusion of any contaminant that may affect the painted area.
- B. It is not permitted to paint over dirty, corroded, scaled, dusted, greased, unprepared surfaces.
- C. Systems components shall be compatible, from the same manufacturer.
- D. The film thickness remains the same independently on the method of application. Subsequent layers will not be applied until the previous layer has been cured, as indicated on the manufacturer's literature.
- E. Apply additional layers when the previous layer is stained. All layers shall have the same uniform color and texture. Specified film thickness shall be verified on corners and edges. Special attention shall be given to assure that the corners, edges, hollows and welds receives the same thickness of

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dry film as in flat surfaces. Do not apply primer when it has been shop applied.

- F. Itinerary for Coating: First coat shall be applied as soon as possible after surface has been prepared. Repeat surface preparation process when there a change in color, loss of required surface profile or fast rusted.
- G. Apply the minimum dry film thickness (dft) required per specified system. When is necessary and/or required by the Engineer, apply a spot primer at critical points before base (primer) coat. Specified coating thickness is not included in this step. Among the critical points are the edges, corners, and elbows.
 - 1. System 1
 - a. Base – 3 mils
 - b. Intermediate – 8 mils
 - c. Finish – 5 mils
 - 2. System 2
 - a. Base – 5 mils
 - b. Intermediate – 5 mils
 - c. Finish – 3 mils
 - 3. System 3 – 20 mils
 - 4. System 4
 - a. Primer – 4 mils
 - b. Finish – 16 mils, applied in two applications of 8 mils each
 - 5. System 5
 - a. Primer – 4 mils
 - b. Base – 8 mils

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- c. Finish – 8 mils
- 6. System 6
 - a. Primer – 3 mils
 - b. Base – 20 mils
 - c. Finish – 20 mils
- 7. System 7
 - a. Filler Coat – Lost substrate shall be replaced with this material to a smooth contour.
 - b. Base – 80 mils, applied in two layers of 40 mils each.
 - c. Finish – 40 mils, applied in two layers of 20 mils each.
- 8. System 8
 - a. Filler Coat – Lost substrate shall be replaced with this material to a smooth contour.
 - b. Base – 80 mils, applied in two layers of 40 mils each.
 - c. Intermediate – 40 mils, applied in two layers of 20 mils each.
 - d. Finish – 10 mils.
- 9. System 9 – 4 mils
- 10. System 10
 - a. Sealer – Apply to a rate of 320 ft² / gal (5 mils) using single or plural component airless spray equipment.
 - b. Rebuild – Fill large voids in concrete to reshape surface or ½” for ultra-protection using a steel trowel or spreader bar.
 - c. Resurface – Spread material to a leveled ¼” layer with a trowel or screed rake.

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- d. Lining – 60 mils, applied in two layers of 30 mils each, with a single or plural component airless spray equipment.

11. System 11

- a. Sealer – Apply to a rate of 320 ft² / gal (5 mils) using single or plural component airless spray equipment.
- b. Rebuild – Fill large voids in concrete to reshape surface or ½” for ultra-protection using a steel trowel or spreader bar.
- c. Lining – 80 mils, applied in two layers of 40 mils each, with a single or plural component airless spray equipment.

12. System 12

- a. Base – 20 mils
- b. Finish – 20 mils

3.4 QUALITY CONTROL

- A. The Authority reserve the right to request at any time, and many times as necessary, the following tests during the application:
 - 1. The Authority may contract the services of an independent laboratory to sample the products that are been used. The samples will be taken in the presence of the Contractor.
 - 2. The laboratory will analyze the sample for the following characteristics per Authority request:
 - a. Material's Quantitative Analysis.
 - b. Corrosion Resistance
 - c. Apparent Reflectivity
 - d. Flexibility
 - e. Opacity
 - f. Color Retention
 - g. Rust and Alkaline Resistance
 - 3. If the test results show that the material used does not comply with the requirements specified, the Authority will stop the works and may require to the Contractor the disbursement of the testing,

removal of the rejected paint, new surface preparation and new coating at his own cost.

- B. The Contractor will provide to the Engineer the receipts of the materials purchased.
- C. The Contractor shall keep a daily log of field conditions and of the necessary tests to assure the job is being done as specified and according to the manufacturer.
- D. Quality control plan (by contractor except when noted) shall include but no limited to:
 - 1. Non visible contaminants (salts/ions) test using SSPC Guide 15 Method A-2. The test shall be conducted every 500 ft². Surfaces with the following concentrations shall be considered as CONTAMINATED:
 - a. Chlorides > 2 ppm (2 µg/cm² or 20 mg/m²)
 - b. Sulfate > 2.5 ppm (2.5 µg/cm² or 25 mg/m²)
 - c. Nitrate > 5 ppm (5 µg/cm² or 50 mg/m²)

This test shall be performed before surface preparation, before primer coat and between each coating layer.

In the case that any level exceed the maximum allowable, a water-CHLOR*RID 1:50 solution shall be used to pressurized (5,000 psi) blast cleaning the affected area.

- 2. If 8 hours or more have been elapsed without coating been applied or flash rust is present, contractor shall prepare the surface again at his own cost.
- 3. Surface profile test shall be performed with a digital gauge similar to Elcometer 224.
- 4. Tests shall be performed and recorded for ambient conditions such as temperature, relative humidity and dew point.
- 5. Substrate surface temperature shall be checked and recorded before any coating application.

6. Every mixing procedure shall be documented with the mixing ration, mixing duration and dwell duration.
 7. Wet film thickness shall be checked.
 8. Dry film thickness test shall be performed with a digital meter similar to PosiTector 6000 in conformance with SSPC-PA2.
 9. Adhesion test will be performed by with a Defelsko PosiTest AT-A automatic tester.
 10. Holiday Test to 100% of the surface with a high voltage contact probe.
 11. All the inspections and tests shall be performed in the presence of PREPA's inspector.
- E. The Contractor shall keep accessible all the information related to the equipment used for inspections and tests, including equipment technical data and calibration.
- F. The contractor shall prepare a quality control plan for PREPA's approval. The plan shall be signed by the quality control personnel.
- G. Before any coating layer, contractor shall clean the surface to a grade of SSPC-SP1 using thinner for exterior surfaces and alcohol 98% for interior surfaces.
- H. Contractor shall be responsible to record keeping of all data and the spatial relationship to the structure.
- I. All inspection equipment shall be calibrated and operated by certified personnel.

3.5 HOUSE KEEPING

- A. Empty containers, covers, debris, residuals and all unnecessary material in the working area shall be properly removed and disposed daily.

3.6 PROTECTION

- A. Protect all equipment and completed work done in adjacent areas.

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- B. Damages shall be repaired, replaced or recoated per Engineer's requirements.

3.7 SECURITY

- A. Coatings/paintings shall be done following the safety measures recommended by the manufacturer and required by the Safety Engineer in charge. The Contractor shall follow at all time the best management practice plan (BMPP) and safety regulations established by the Authority to assure a safe working environment to the personnel.

3.8 COLORS

- a. Upon Contractor's formal request, PREPA shall select the colors for all the approved system coatings, including all the paint and primer components of the approved coating system.

END OF SECTION 09900

SECTION 15455 - STORAGE TANK

PART 1 - GENERAL

1.1 RELATED DOCUMENT

- A. Drawings and general provisions and Contract, including General and Supplementary Conditions and Specification sections, apply to work of this section.

1.2 SCOPE OF WORK

- A. This section includes the methods for the rehabilitation or replacement for fuel or water tanks. Including, among other, tank cleaning, repair of damages, bottom replacement, shell replacement, roof replacement, stairs, etc.
- B. The extent of storage tanks work is indicated on drawings and special conditions.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of storage tanks of types and sizes required, whose products have been in satisfactory use in similar service for not less than 10 years.
- B. Installer's Qualifications: Firms with at least 3 years of successful installation experience on projects with storage tank work similar to that required for project.
- C. Codes and Standards
 - 1. ASME Code Symbol Stamps: Comply with ASME Boiler and Pressure Vessel Code requirements for storage tank construction, and stamp with ASME Code symbol requirements.
 - 2. AWWA Compliance: Comply with applicable requirements of American Water Works Association standards pertaining to steel

water tanks.

3. API Compliance: Comply with applicable requirements of American Petroleum Institute standards pertaining to steel water tanks.
 - a. API-650 New Constructions
 - b. API-653 Inspection, Repair, Alteration, and Reconstruction

1.4 SUBMITTALS

- A. Gas free certification and technician qualification record.
- B. Nondestructive test and written procedure with technician qualification record.
- C. Hydrostatic test report.
- D. Welding procedure specification, procedure qualification record and welder qualification record.
- E. Mill test report.
- F. Product Data: Submit manufacturer's technical product data, with size, capacity, and weight of selected model, and furnish specialties and accessories indicated, and also installation and start-up instructions.
- G. Shop Drawings: Submit manufacturer's assembly type shop drawings indicating dimensions, weights, required clearances, and methods of assembly of all components.
- H. Maintenance Data: Submit maintenance data and parts lists for each type of storage tank. Include "trouble-shooting" maintenance guides. Include that data, product data, and shop drawings in maintenance manual.

PART 2 - PRODUCTS

2.1 STEEL STORAGE TANK

- A. The construction of the tank will be following the API 650 code.
- B. Inspection, repair, alteration, and reconstruction of the tank will be following the API 653 code.
- C. Structural steel shall be ASTM A-36 made in the USA.
- D. Corrosion allowance shall be 1/16 of an inch, unless otherwise noted in special conditions.
- E. Stair Construction: Hot-dipped galvanized steel.
- F. Lining: Refer to special condition (15010) and Paint Specification (09900)
- G. Manholes: Provide manholes and covers for tanks over 36" diameter, of sizes and locations as indicated.
- H. Penetrations: Provide penetrations of size and location as indicated; threaded female for 2" and smaller, flanged for 2-1/2" and larger.

2.2 FLANGES

- A. All nozzles shall be seamless schedule 80 in accordance with ASTM A-53 grade B, made in USA.
- B. All flanges shall have 150# class rating in accordance with ANSI B16.5, made in USA.

2.3 VALVES

- A. Gate valves shall have 150# class rating, cast steel body (ASTM A216-WCB), flange connections, round bolted bonnet, API 600 classification, outside screw and yoke, SS 410 stem, 13Cr faced WCB wedge, CoCr alloy faced carbon steel seat, and seal welded seats. A gear actuator with positioner shall be installed for valves size 6" or larger. Made in USA.

- B. Check valves shall be swing type with 150# class rating, cast steel body and cover (ASTM A216-WCB), flange connections, round bolted cover, one piece disc with CoCr alloy facing. Made in USA
- C. Control valves shall be globe type with 150# class rating, cast steel body (ASTM A216-WCB), flange connections, bolted bonnet, rising stem pneumatic actuator and positioner. Made in USA.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which storage tanks are to be installed, and substrate which will support storage tanks. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 TANK REPAIR

- A. Tank Shell
 - 1. Shell repairs shall be in accordance with Section 9 of API-653 fifth edition, November 2014.
 - 2. Minimum dimension of a replacement shell plate shall be 12" or 12 times the thickness of the replacement plate, whichever is greatest.
 - 3. Details shown in figure 9.1 of API-653 shall be followed for all replacements of shell plate material.
 - 4. Lap welded patches are NOT allowed, unless clearly specified in special conditions.
- B. Shell Penetrations
 - 1. Projects that required hydrostatic testing; shell penetrations shall be altered to comply with API 650, Section 5.7, including the requirements for minimum reinforcing area and the requirement for spacing of weld around connections. Figure 5.6 of API-650 shall be followed.

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2. Addition or replacement of shell penetrations shall be in accordance with material, design, and stress relief requirements of API 650, Section 5.7 and in accordance with API 653, sections 9.8.2 through 9.8.6.

C. Tank Bottom

1. All bottom repairs shall be in accordance with API 653, Section 9.10.
2. When installing a new bottom, the following requirements shall be met:
 - a. Installation of a geotextile padding, flexible membrane liner and leak detection piping network according to Specification 09800 and drawings.
 - b. Installation of a cathodic protection system according to Specification 16642 and drawings.
 - c. Installation of a sand bed ranging from 4" at the shell to 6" at the center of the existing bottom.
 - d. Shell will be uniformly slotted parallel to the existing bottom and all edges shall be deburred. The new bottom plate shall be installed and welded according to API 650.
3. Roof
 - a. Roof plates and structural members shall be repaired using the same material, thickness and arrangement as presented in the original tank fabrication drawings.
 - b. Distorted plates shall be replaced in accordance to API 650.
 - c. Tank venting shall never be blocked.
 - d. Pipe type roof columns shall be sealed at the bottom with a fully welded blind cover.

3.3 WELDING

- A. All welds shall accomplished full penetration to the base metal and comply with all requirement of API 653 & API 650.
- B. Welding Procedure Specification (WPS), Procedure Qualification Records (PQR), and Welder Performance Qualification (WPQ) shall be submitted for each job.
- C. All welds shall be performed with shielded metal arc welding (SMAW), automatic submerged-arc welding (SAW) and/or gas tungsten arc welding (GTAW).
- D. Welding Qualifications
 - 1. All procedures shall be in accordance with ASME Boiler & Pressure Vessel Code, Section IX.
 - 2. Welding Procedure Specification and Procedure Qualification Records shall only be submitted by the fabricator company. Welders shall be qualified for the specific job and in accordance with ASME Boiler & Pressure Vessel Code, Section IX.
- E. Welds defects and repairs shall be determined using the criteria shown in API 653, Section 9.6.
- F. Welds shall be inspected with the following non-destructive tests:
 - 1. Bottom Welds
 - a. 100% vacuum box testing.
 - b. Radiograph testing for all welds in annular plates.
 - 2. Shell to bottom Weld
 - a. 100% right angle vacuum box testing for shell to bottom joint.
 - b. Overnight light oil wicking action test for the first shell to bottom weld.

- c. Shell to bottom joint under welded-on patch and 6" beyond both sides shall be fully examined by magnetic particle or liquid penetrant test.

3. Shell Penetrations

- a. Shell shall be examined for laminations with ultrasonic testing.
- b. Nozzle to shell weld shall be examine by magnetic particle or liquid penetrant.

4. Shell Course

- a. Shell butt-welds shall be examine by visual and radiographic or ultrasonic methods.
- b. Areas with removed welds shall be examined by magnetic particle or liquid penetrant method.
- c. Radiographic number and location shall follow API 653, Section 12.2.

3.4 NDE TEST

A. Visual

- 1. Welds will be accepted if API 650, Section 8.5.2 parameters are fulfilled.
- 2. The visual inspection method shall be in accordance with ASME Boiler and Pressure Vessel Code, Section V.

B. Liquid Penetrant

- 1. Technician performing this test shall comply with the requirements of API 653, Section 8.4.3.
- 2. The liquid penetrant method shall be in accordance with ASME Boiler and Pressure Vessel Code, Section V.

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C. Radiographic

1. Procedure, location and quantity of radiograph shall be in accordance with API 653, Section 8.1.

D. Vacuum Box

1. Procedure, location and quantity of radiograph shall be in accordance with API 653, Section 8.6.

E. Hydrostatic Test

1. All tank connections shall be isolated.
2. Test shall be performed before applying the coating system.
3. Procedure shall be in accordance with API 650, Section 7.3.6.

3.5 SITE CLEANING

- A. All equipment, temporary facilities and scrap material shall be removed from the site and disposed.
- B. Contractor shall be responsible for any damage to permanent structures or equipment affected during construction. Original conditions shall be reestablished.

END OF SECTION 15455

SECTION 15456 PROCEDURE FOR HAZARDOUS MATERIAL WORK AND THE HANDLING AND DISPOSAL OF DEBRIS

PART 1 - GENERAL

1.1 SUMMARY

A. SCOPE OF WORK

This section describes methods for working with painted surfaces containing hazardous elements, procedures to follow in the handling of debris, its transportation and disposal.

- B. The Contractor shall implement programs and procedures which comply with the requirements of this specification and all applicable Federal, state, and local OSHA, EPA and Environmental Quality Board standards and regulations.

1.2 DEFINITIONS

A. Heavy Elements:

Lead, cadmium, chromium, arsenic, barium, mercury, selenium and silver.

B. Hazardous Waste as defined in 40 CFR 261:

Paint debris that contains any of the elements in the concentrations listed below, after testing by Toxicity Characteristic Leaching Procedures (TCLP).

Arsenic	5 mg/l
Barium	100 mg/l
Cadmium	5 mg/l
Chrome	5 mg/l
Lead	5 mg/l
Mercury	0.2 mg/l
Selenium	1 mg/l
Silver	5 mg/l

Note: other elements and characteristics can cause a material to be hazardous as defined in 40 CFR 261 and must be taken into consideration.

C. Hazardous Work:

The alteration, repair, cutting, or demolition of any structure that can generate hazardous waste.

D. Generated Waste:

All paint debris, materials used for its removal (abrasives and water), water used for personal hygiene and all contaminated soil.

E. Dangerous Waste:

Waste that exhibits any of the following characteristics: reactivity, corrosivity, ignitability and toxicity as defined in 40 CFR 261.

F. Containment System:

Includes the containment structure (i.e., walls, floor, supporting structure); ventilation system (forced or natural air input ports, and natural or mechanical exhaust); and, in some cases dust collection equipment.

G. Manifest:

The paperwork initiated by the generator when hazardous waste is generated and provided for transportation and disposal as defined in 40 CFR 261.

H. Generator:

Facility owner or operator or person who first creates a hazardous waste.

1.3 APPLICABLE DOCUMENTS

A. OSHA

1. General Industry Standards - 29 CFR 1910
2. Construction Industry Standards - 29 CFR 1926

B. EPA

1. National Primary and Secondary Ambient Air Quality Standards - 40 CFR 50
2. Identification and Listing of Hazardous Waste - 40 CFR 261

3. Standards Applicable to Generators of Hazardous Waste - 40 CFR 262
 4. Standards Applicable to Transporters of Hazardous Waste Treatment, Storage and Disposal Facilities - 40 CFR 263
- C. SSPC
1. Guide 6 - Guide for Containing Debris Generated During Paint Removal Operations
 2. Guide 7 - Guide for the Disposal of Lead Contaminated Surface Preparation Debris
- D. All other applicable standards and regulations.

1.4 REQUIRED DOCUMENTS

- A. Test results from the sampling of air, personnel, soil, water, etc., asked for in the specifications or regulations. These shall be evaluated by PREPA's personnel.
- B. A Work Plan shall be submitted for approval, before commencing the work.
- C. Environmental Quality Board permits for soil and air.
- D. Copy of the Uniform Hazardous Waste Manifest, for all stages of shipment.

PART 2 - PRODUCTS

(NOT APPLICABLE)

PART 3 - EXECUTION

3.1 WORK PLAN

- A. The Contractor shall submit a detailed Work Plan that demonstrates his knowledge and previous compliance with existing regulations and practices. This shall describe, in detailed form, the methods to be utilized to realize the work.
- B. The Work Plan shall be specific for the work to be done. General or generic plans and procedures shall not be accepted.
- C. All work to be subcontracted shall be specified in the Work Plan. The Contractor shall submit evidence of the subcontractor's qualifications.
- D. The work plan shall include, among other things, the following information:
 - 1. A list of the personnel that will be conducting the work and evidence that each worker has had proper training, medical exams, certifications, qualifying tests, etc., including Subcontractor's personnel.
 - 2. Compliance plans for works dealing with lead, cadmium and arsenic. Also the requirements for working in confined spaces, if these apply, an entry to a confined space program shall also be included.
 - 3. Subcontractors that will provide services such as: analyses, sample testing, waste handling and transportation, land filling, etc.
 - 4. A Contingency Plan in case of spillage of hazardous material.

3.2 PERMITS

- A. PREPA will seek approval of the project's "Environmental Impact Statement" from the Environmental Quality Board. PREPA will give the contractor EPA identification number as generator.
- B. The Contractor shall be responsible of obtaining all permits, including those for air and soil, and of notifying the proper regulatory agencies in coordination with the Engineer and the PREPA Environmental Protection Division.
- C. The Contractor shall not mobilize until having submitted prior evidence that all required permits have been obtained from the proper regulatory agencies.

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3.3 EMPLOYEE PROTECTION

- A. The Contractor shall coordinate all work to be done with the Plant Safety Engineer.
- B. The Contractor shall assure that his employees comply with the MSDS instructions for each product handled.
- C. When working with materials containing lead, cadmium, or arsenic, the Contractor shall:
 - 1. Comply with the requirements specified in the 29 CFR 1926.62 for lead, 29 CFR 1926.63 for cadmium and in 29 CFR 1926.1118 for arsenic, latest revisions, as they apply.
 - 2. Carry out monitoring of his personnel as follows:
 - a. Lead, cadmium and arsenic samples shall be collected (as apply) from 25% of the personnel for each activity they realize.
 - b. The samples shall be collected prior to commencing the activities so that exposure levels can be established. A minimum of three additional samples shall be collected afterwards. The times for such sampling shall be determined by the Plant Safety Engineer.
 - c. The results will be delivered to the Plant Safety Engineer as soon as they are obtained.
 - d. Each sampling will be carried out during the eight-hour work shift, unless otherwise indicated by the regulations.
 - 3. Provide his employees the required protective equipment.
 - 4. Train his personnel.
 - 5. Be responsible for the applicable medical exams of his personnel.
 - 6. If the sample exceeds the permitted exposition levels (PEL's), appropriate measures shall be taken to protect his personnel.
- D. When working under the presence of the other heavy metals listed the Contractor shall:
 - 1. Carry out his own sample tests.

- a. Lead, cadmium and arsenic samples shall be collected (as apply) from 25% of the personnel for each activity they realize.
- b. The samples shall be collected prior to commencing the activities so that exposition levels can be established.
- c. The results shall be delivered to the Safety Engineer as soon as they are obtained.
- d. Each sampling will be carried out during the eight-hour shift unless the regulations indicate otherwise. He shall:
 1. Provide his employees the required protective equipment.
 2. Train his personnel.

3.4 CRITERIA FOR ESTABLISHING A LIMITED WORK AREA

- A. The Contractor shall restrict the work area to its own personnel and to PREPA's inspection group, when realizing any hazardous activity. It is PREPA'S responsibility to assure that the contractor takes all the steps necessary to avoid contamination in areas used to store materials and/or wastes.

3.5 CRITERIA FOR CONTAINMENT SYSTEMS

- A. The Contractor shall design a system that will enclose the work area for the protection of the environment. The design shall be revised by the Safety Engineer prior to its installation.
- B. Containment System requirements based on the paint removal method used:
 1. For open abrasive cleaning with non-recycled abrasives.
 - a. Impermeable walls with rigid supporting frames with, completely sealed joints and entryways.
 - b. Forced air ventilation (Negative pressure shall be tested).
 - c. Waste Collection System.
 2. For abrasive cleaning with pressurized water and sodium bicarbonate.

- a. Impermeable walls with a flexible supporting frame.
 - b. Natural ventilation is provided.
3. For an abrasive vacuum cleaning or power tool with vacuum attachments cleaning.
 - a. Flexible containment with minimal support per working area.
 - b. Does not require ventilation or a waste collection system.
 - c. The work environment within the system shall be controlled according to the criteria described in Section 3.3.

3.6 AIR QUALITY EMISSIONS

- A. The Contractor shall collect samples for lead and particulate matter produced in the work area according to 40 CFR 50. The test results shall be given to the Environmental Engineer for evaluation.
- B. Particulate collection equipment shall be utilized with PM-10 headers for any particulate matter leaving the enclosure. The permitted criterion for this equipment will be $150 \mu\text{g}/\text{m}^3$ in a 24 hours period. For an eight hour period a $450 \mu\text{g}/\text{m}^3$ criterion shall be considered.
- C. Lead sampling when working with lead containing material, particulate collection equipment shall be used for a sampling for total suspended particulate-TSP. The filters shall be analyzed for lead according to Appendix G of EPA's 40 CFR Part 50. The permitted criterion is $1.5 \mu\text{g}/\text{m}^3$ in an average 90-day period. This shall be adjusted according to the work schedule.
- D. Four to eight samples shall be collected with each equipment prior to commencing work that can generate lead particulate matter.
- E. Work shall be stopped if the permitted levels are exceeded. The Contractor shall take the necessary measures to lower the emissions and continue work. Sampling shall be taken until the permitted levels are reached.

3.7 GENERATED WASTE EVALUATION

- A. The Contractor shall be responsible for the containment of waste generated during the project. This shall be tested to determine its hazardous nature as per rule 40 CFR 261.

- B. The test results shall be given to the Environmental Engineer and the Substances and Waste Management Department.
- C. If the analysis shows hazardous characteristics, PREPA shall obtain an EPA ID generator number based on the amount of waste generated.

3.8 HANDLING, TRANSPORTATION AND DISPOSAL OF GENERATED WASTE

- A. The Contractor shall be responsible for the handling, transportation and disposal of generated waste, and of complying with all the applicable regulations, state as well as federal, including but not limited to:
 - 1. Environmental Quality Board Regulations
 - 2. EPA, 40 CFR 262
 - 3. EPA, 40 CFR 263
- B. If the generated waste does not exhibit any hazardous characteristics, the Contractor can dispose of it in an Environmental Quality Board authorized municipal or industrial landfill previously approved by PREPA.
- C. If the waste is classified hazardous, the Contractor shall handle it as such and dispose it outside of Puerto Rico in a TSDF previously approved by PREPA.
- D. PREPA will designate the area to be used by the Contractor for temporary storage of generated waste during the project's duration. The Contractor shall follow the requirements for storage time, quantity of stored material, containers to use, and training of personnel specified in the regulations.
- E. The generated waste will be placed in a protected terrain and will be covered in an adequate manner so as to prevent material dispersion caused by wind or rain. Any evidence of noncompliance will cause PREPA to take corrective measures.
- F. The Contractor shall arrange for adequate transportation of the waste from the site to the qualified landfill.
- G. The Contractor shall be responsible of generating the "Manifest" in coordination with the environmental Engineer assigned to the project.

3.9 ARCHIVE DOCUMENTS

- A. The Contractor shall maintain a log of all hazardous material works and

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waste disposal activities.

- B. Logbook shall be available at work site for inspection of PREPA personnel.
- C. The log shall include, but will not be limited to the following information:
 - 1. A sample test taken, dates, laboratories used, names of persons who took the samples, etc.
 - 2. Test results.
 - 3. Personnel medical exam information.
 - 4. Personnel training.
 - 5. Documentation of the company's expertise in transporting hazardous waste.
 - 6. Documentation about landfills for TSDF.

END OF SECTION 15456

SECTION 15457 WORK IN CONFINED SPACES

PART 1 GENERAL

1.1 Related Documents

PREPA drawings, general provisions of this Contract, Special Conditions and other applicable Sections.

1.2 SUMMARY

- A. This Section includes the requirements for work to be done in confined spaces.
- B. All work shall be done according to the OSHA's standard for confined spaces, title 29, Code of Federal Regulations, Part 1910.146, which contains the requirements for practices and procedures to protect employees in general industry from the hazards of entry into permit - required confined spaces.

1.3 DEFINITION

- A. Confined Space: Has limited or restricted means of entry or exit. Is large enough for an employee to enter and perform assigned work, and is not designed for continuous occupancy by the employee. These may include, but are not limited to tanks, pits, diked areas, and vessels.
- B. Permit - required confined space: Is one that meets the definition of a confined space, and has one or more of the following characteristics:
 - 1. Contains or has the potential to contain a hazardous atmosphere.
 - 2. Contains a material that has the potential of engulfing an entrant.
 - 3. Has an internal configuration that might cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward.
 - 4. Contains any other recognized serious safety or health hazard.

1.4 REQUIRED DOCUMENTS

- A. Work schedules.
- B. A written permit entry program.
- C. Results of internal atmospheric tests, as described in Section 3.2, A-3.
- D. Written procedures of the described tasks in Section 3.2.A-8.
- E. An entrance permit for the Engineer. See Section 3.3.
- F. Certification of training provided to workers who are required to work in confined spaces.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 WARNINGS

- A. Contractor shall inform his personnel of the existence, location, and danger posed by the confined spaces. All plant and Contractor personnel shall be warned by means of signs reading:

PELIGRO - ESPACIO CONFINADO
SE REQUIERE PERMISO PARA ENTRAR

DANGER - PERMIT REQUIRED
CONFINED SPACE - AUTHORIZED ENTRANTS ONLY

- B. The warning sign shall be posted at the confined space entrance and exit.

3.2 ENTRY PROGRAM

- A. The Contractor shall prepare an entry program in which all the information required in the 29 CFR.1910.146 is included. It shall be submitted to the Engineer for approval prior to commencing of work. It shall cover the following:

- 1. Entrance to the confined space shall be identified in coordination with the

San Juan Steam Plant
Fuel Oil #6 Service Tank S-10 Rehabilitation
RFP 0002682

Engineer.

2. The Contractor shall meet with the security Engineer to discuss the entry operations, precautions, or procedures applicable to confined spaces.
3. Prior to entering, the Contractor shall take internal atmospheric tests for oxygen, flammable gases vapors, and for potentially toxic air contaminants. A calibrated instrument shall be used with direct reading according to appendix B of 29CFR 1910.146.
4. The Contractor shall identify hazards and precautions or procedures to be followed prior entering any permit space and inform the Engineer of such.
5. Develop and implement procedures such that any operations inside the tank are safe including providing necessary ventilation and lighting equipment.
6. The Contractor shall provide the following to his personnel:
 - i. Test and monitoring equipment
 - ii. Ventilation equipment
 - iii. Communication equipment
 - iv. Personnel protective equipment
 - v. Lighting equipment
 - vi. Emergency and rescue equipment
7. An attendant shall remain outside the confined space during entry operations unless relieved by another authorized attendant.
8. The Contractor shall develop the following written procedures for the following tasks. These shall be submitted to the Engineer.
 - i. Procedures for summoning emergency and rescue services.
 - ii. Procedure for the preparation, issuance and cancellation of entrance permits.

- iii. Procedure for the operations to be carried inside the confined space.

3.3 PERMITS

- A. The permit system and the entrance permits shall be according to 29CFR 1910.146 © and (f) respectively. The Contractor shall prepare an entrance permit signed by the entry supervisor. Verify that pre-entry preparations have been completed and that the space is safe to enter. It must be posted at entrances and made available to the Engineer.

3.4 TRAINING

- A. Training for all workers who are required to work in confined spaces shall be responsibility of the Contractor and shall be done according to 29 CFR 1910.146 (g). The Contractor shall provide written evidence of such.
- B. The Contractor shall ensure that rescue service personnel is trained in the proper use of personal protective and rescue equipment, including respirators. Also, trained to perform assigned rescue duties, and have had authorized entrants training. Rescuers shall be trained and certified, in First Aid and Cardiovascular Resuscitation (CPR).

END OF SECTION 15457

(6)

PAYMENT BOND



PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS, That we

(hereinafter called the Principal), and
a corporation organized and existing under the laws of the State of
and authorized to transact business in Puerto Rico, (hereinafter called
the Surety), are jointly and in solid held and firmly bound unto the PUERTO RICO
ELECTRIC POWER AUTHORITY, a public corporation and governmental
instrumentality of the Commonwealth of Puerto Rico, in the penal sum of
lawful money of the United States,
for the payment of which sum well and truly to be made, we bind ourselves, our
heirs, executors, administrators, and successors.

The condition of this obligation is such, that whereas the Principal entered
into a certain contract with the PUERTO RICO ELECTRIC POWER AUTHORITY, dated
numbered for

which contract is hereby referred to and made a part as fully and to the same
extent as if copied at length herein.

NOW THEREFORE, if the principal shall promptly make payment to all
persons supplying labor, equipment, tools and materials in the prosecution of the
work provided for in said contract, and any and all duly authorized modifications
of said contract that may hereafter be made, notice of which modifications to the
surety being hereby waived, then this obligation to be void; otherwise to remain
in full force and virtue.

IN WITNESS WHEREOF, the above jointly and in solid bound parties have
executed this instrument under their several seals this day of
19 , the name and corporate seal of each corporate party being hereto affixed
and these presents duly signed by its undersigned representative pursuant to
authority of its governing body.

WITNESS:

(PRINCIPAL) (SEAL)

(IF INDIVIDUAL OR FIRM) (SEAL)

ATTEST: _____ (SEAL)

(IF CORPORATION) (SEAL)

(SURETY)

ATTEST: _____

By: _____

Countersigned:

The rate of premium on this bond is _____ per thousand.

Total amount of premium charged, \$ _____

(THE ABOVE MUST BE FILLED IN BY SURETY)

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the secretary of the corporation named as principal in the within bond; that who signed the said bond on behalf of the principal, was then of said corporation, that I know his signature, and his signature thereto is genuine; and that said bond was duly signed, sealed, and attested for and in behalf of said corporation by authority of its governing body.

[CORPORATE]
SEAL

INSTRUCTIONS

1. This form shall be used for construction work or the furnishing of supplies or services, whenever a performance bond is required. There shall be no deviation from this form except as authorized by the Puerto Rico Electric Power Authority.

2. The surety on the bond may be any corporation authorized by the Superintendent of Insurance of Puerto Rico to act as surety and the bond must be countersigned, in the space provided therefore, by the agents of the surety in Puerto Rico.

3. The name, including full Christian name, and business or residence address of each individual party to the bond shall be inserted in the space provided therefore, and each such party shall sign the bond with his usual signature on the line opposite the scroll seal.

4. If the principals are partners, their individual names shall appear in the space provided therefore, with the recital that they are partners composing a firm, naming it, and all the members of the firm shall execute the bond as individuals.

5. If the principal is a corporation, the name of the State in which incorporated shall be inserted in the space provided therefore and said instrument shall be executed and attested under the corporate seal as indicated in the form. If the corporation has no corporate seal the fact shall be stated, in which case a scroll or adhesive seal shall appear to following the corporate name.

6. The official character and authority of the person or persons executing the bond for the principal, if a corporation, shall be certified by the secretary or assistant secretary, according to the form herein provided. In lieu of such certificate there may be attached to the bond copies of so much of the records of the corporation as will show the official character and authority of the officer signing, duly certified by the secretary or assistant secretary, under the corporate seal, to be true copies.

7. The date of this bond must not be prior to the date of the instrument in connection with which it is given.

(7)

PERFORMANCE BOND



PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, That we

(hereinafter called the Principal), and
a corporation organized and existing under the laws of the State of
and authorized to transact business in
Puerto Rico, (hereinafter called the Surety), are held and firmly bound unto the
PUERTO RICO ELECTRIC POWER AUTHORITY, a public corporation and
governmental instrumentality of the Commonwealth of Puerto Rico, in the penal
sum of _____ lawful
money of the United States, for the payment of which sum well and truly to be
made, we bind ourselves, our heirs, executors, administrators, and successors,
jointly and severally, firmly by these presents.

The condition of this obligation is such, that whereas the Principal
entered into a certain contract with the PUERTO RICO ELECTRIC POWER
AUTHORITY, dated _____ numbered _____ for _____

which contract is hereby referred to and made a part hereof as fully and to the
same extent as if copied at length herein.

NOW, THEREFORE, if the Principal shall well and truly perform and fulfill
all the undertakings, covenants, terms, conditions, and agreements of said
contract during the original term of said contract and any extensions thereof that
may be granted by the PUERTO RICO ELECTRIC POWER AUTHORITY,
with or without notice to the Surety, and during the life of any guaranty required
under said contract, and shall also well and truly perform and fulfill all the
undertakings, covenants, terms, conditions, and agreements of any and all duly
authorized modifications of said contract that may hereafter be made, notice of
which modifications to the Surety being hereby waived, then, this obligation to
be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above bound parties have executed this
instrument under their several seals this _____ day of
19____, the name and corporate seal of each corporate party being hereto
affixed and these presents duly signed by its undersigned representative
pursuant to authority of its governing body.

WITNESS:

_____(SEAL)
(PRINCIPAL)

_____(SEAL)
(IF INDIVIDUAL OR FIRM)

ATTEST: _____(SEAL)

_____(SEAL)
(IF CORPORATION)

(SURETY)

ATTEST:

By: _____

Countersigned:

The rate of premium on this bond is _____ per thousand.

Total amount of premium charged, \$ _____

(THE ABOVE MUST BE FILLED IN BY SURETY)

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the
secretary of the corporation named as principal in the within bond;
that

who signed the said bond on behalf of the principal, was then
_____ of said corporation, that I know his signature, and his signature
thereto is genuine; and that said bond was duly signed, sealed, and attested for
and in behalf of said corporation by authority of its governing body.

[CORPORATE]
SEAL

INSTRUCTIONS

1. This form shall be used for construction work or the furnishing of supplies or services, whenever a performance bond is required. There shall be no deviation from this form except as authorized by the Puerto Rico Electric Power Authority.

2. The surety on the bond may be any corporation authorized by the Superintendent of Insurance of Puerto Rico to act as surety and the bond must be countersigned, in the space provided therefor, by the agents of the surety in Puerto Rico.

3. The name, including full Christian name, and business or residence address of each individual party to the bond shall be inserted in the space provided therefor, and each such party shall sign the bond with his usual signature on the line opposite the scroll seal.

4. If the principals are partners, their individual names shall appear in the space provided therefor, with the recital that they are partners composing a firm, naming it, and all the members of the firm shall execute the bond as individuals.

5. If the principal is a corporation, the name of the State in which incorporated shall be inserted in the space provided therefor, and said instrument shall be executed and attested under the corporate seal as indicated in the form. If the corporation has no corporate seal the fact shall be stated, in which case a scroll or adhesive seal shall appear following the corporate name.

6. The official character and authority of the person or persons executing the bond for the principal, if a corporation, shall be certified by the secretary or assistant secretary, according to the form herein provided. In lieu of such certificate there may be attached to the bond copies of so much of the records of the corporation as will show the official character and authority of the officer signing, duly certified by the secretary or assistant secretary, under the corporate seal, to be true copies.

7. The date of this bond must not be prior to the date of the instrument in connection with which it is given.

(8)

SWORN STATEMENT



DECLARACIÓN JURADA NO CONFLICTO DE INTERESES (Renovación Anual)

Comparece _____ una _____
(nombre de la compañía) (corporación, sociedad o individuo)
organizada, existente y autorizada para hacer negocios bajo las leyes de Puerto Rico, con Seguro Social
_____, representada en este acto por _____,
(patronal o individuo) (nombre del representante)
mayor de edad, _____ y vecino de _____,
(estado civil) (domicilio)
juramento declaro lo siguiente:

1. Que mi nombre y demás circunstancias personales son las antes indicadas.
2. Que ocupo la posición de _____ en la compañía arriba indicada.
(título)
3. Que _____ ha presentado o presentará una oferta de
(nombre de la compañía)
subasta ante la Autoridad de Energía Eléctrica de Puerto Rico (AEE) para proveer lo siguiente: _____

4. Los directores y oficiales de _____ tienen la intención
(nombre de la compañía)
de participar en una invitación a subasta. Estos informan que no existe conflicto de intereses por motivo
de relaciones de familia, relaciones comerciales o económicas, o por cualquier otra razón entre ellos y la
AEE, sus oficiales, empleados y agentes.
5. Se incluye una certificación firmada por el Secretario indicando el nombre, dirección de los directores y
oficiales de la corporación.
6. Se presenta esta declaración jurada con el propósito de certificar que la compañía, sus directores y
oficiales no están en posición de tener conflicto de intereses de clase alguna en caso que se otorgue a
esta corporación la invitación a una subasta.
7. Se presenta esta declaración jurada, además, con el propósito de certificar y garantizar que
_____ ha rendido planilla contributiva durante los últimos cinco
(nombre de la compañía)
(5) años, no adeuda contribuciones y ha pagado las contribuciones de seguro por desempleo, de
incapacidad y de seguro social para choferes (la que aplique), al Estado Libre Asociado de Puerto Rico, o
que _____ se encuentra acogida a un plan de pago, con cuyos
(nombre de la compañía)
términos y condiciones está cumpliendo. Expresamente se reconoce que ésta es una condición esencial de
cualquier contrato que _____ firme con la AEE, y de no ser
(nombre de la compañía)
correcto en todo o en parte la anterior certificación, eso será causa suficiente para que la parte contratante
(AEE), pueda dejar sin efecto el mismo y la parte contratada _____
(nombre de la compañía)
cuyo representante es el firmante de esta declaración jurada, tendrá que reintegrar a la parte contratante
(AEE) toda suma de dinero recibida bajo contrato. Esta disposición será extensiva a todo subcontratista de
de _____ considerándose como tales, además, los
(nombre de la compañía)

profesionales o técnicos que sean utilizados por _____ para cumplir con
(nombre de la compañía)
sus obligaciones contractuales con la parte contratante (AEE). Será responsabilidad de
_____ proveer las certificaciones de sus subcontratistas a tales efectos.
(nombre de la compañía)

8. Se somete esta declaración jurada para la consideración de la AEE, durante el período de
_____ al _____. Es nuestra obligación informar a la AEE de
(un año a partir de la fecha de notariación)
cualquier cambio de status que pudiese afectar nuestra declaración sobre conflicto de interés.
9. Que suscriba esta declaración en cumplimiento con la Ley Núm. 458 de 29 de diciembre de 2000, según enmendada.

PARA QUE ASÍ CONSTE, juro y suscribo la presente en _____ Puerto Rico,
hoy _____ de _____ de 20_____.

Firma de Declarante

Affidavit Núm. _____

Jurado y suscrito ante mí por _____, de las
circunstancias personales antes indicadas y a quien conozco personalmente, o he identificado
mediante _____, en _____,
Puerto Rico, hoy _____ de _____ de 20_____.

Notario Público

Sello

ANNEX 1

Tank Labeling & Color Code

■ ROTULACIÓN DEL TANQUE

- El contratista proveerá e instalará la rotulación del Tanque. Se requerirá rotulación en (4) cuatro puntos Cardinales, Ej. (Norte, Sur, Este, Oeste) al centro de la penúltima anilla del tanque.
- La AEE seleccionará el área. El contratista deberá remover y reemplazar toda la rotulación existente en el tanque.

El Tanque se identificará de la siguiente forma:

AEE **FIRE PROTECTION**
X,XXX,XXX GALS

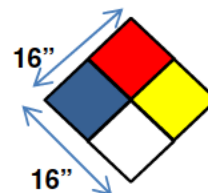
El volumen del tanque se representará numéricamente. **volumen del tanque (GALS)**

El alcance incluye proveer e instalar el Diamante de Comunicación de Riesgo en los (4) puntos cardinales.

NFPA DIAMOND HAZARD LABELING WITH NUMBERS

Las dimensiones mínimas del diamante serán de 16" x 16".

La leyenda numérica del interior del diamante será seleccionada por la AEE.



La rotulación del Tanque tendrá las siguientes características:

- El material deberá ser igual o aprobado igual al ORACAL 951 PREMIUM CAST.

- El color de las letras será seleccionado por la AEE. Se deberá presentar carta de Colores.
- El tipo de letra será Arial.
- El tamaño de las letras será de 8" pulgadas de alto y el logo de 12".
- Largo de cada Rotulo 12'pies.
- El ancho de las líneas que componen cada letra será de 3" pulgadas.
- El material de las letras será de incomparable durabilidad, conformabilidad y estabilidad dimensional.
- Espesor del material de las letras será de 2 mils (*milésimas de pulgada*).
- La durabilidad del material expuesto al exterior (*outdoor*) deberá ser de 10 años.
- El adhesivo será solvente de poliacrilato permanente (*Solvent Polyacrylate*).

El contratista deberá someter una muestra del material a utilizarse para la evaluación y aceptación por la AEE.

El contratista deberá someter el Arte creado para la evaluación y aceptación por la AEE.

Se incluye Logo AEE que será incorporado como parte del Arte en la rotulación del tanque.



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AUTORIDAD DE ENERGÍA ELÉCTRICA DE PUERTO RICO

SAN JUAN, PUERTO RICO

www.aeepr.com



APARTADO 364267
CORREO GENERAL
SAN JUAN, PR 00936-4267

***DIRECTORADO DE GENERACIÓN
COMITÉ CÓDIGO DE COLORES***

Fecha : 28 de septiembre de 2015

Hora : 9:30 a.m.

Lugar : Salón de Conferencias-Oficinas del CASE

DECISIONES DEL COMITÉ CÓDIGO DE COLORES

- Utilizar el Código ANSI / ASME A 13.1-2007 (*Standard for Identification*, para la identificación de las líneas y los tanques.
- Todos los tanques serán blancos, con su identificación correspondiente (el nombre del producto), según el diamante de comunicación de riesgos, NFPA *National Fire Protection* y con el logo de la Autoridad.
- Debe haber iluminación apropiada y ésta debe ser a prueba de explosión (explosion proof). Se indicó que es bien importante porque los accidentes, por lo general, ocurren en las noches.
- Cada tanque tendrá una rotulación que será en proporción al tamaño de cada tanque (establecido por vida útil) y que especifique su capacidad.
- Se realizarán las inspecciones de los tanques cada 5 años.

Tanques:

Tanques	
Unidad de Medida	Contenido
Barriles	Bunker C
Galones	Light Oil – Diésel- Agua

FINAL EFFLUENT TANK ← 8"A X 92"L
825,350 GALS ← 2"A X 109"L
 ← 8"A X 48"L
 11 PIES DE LARGO X 23 PULGADAS DE ALTO

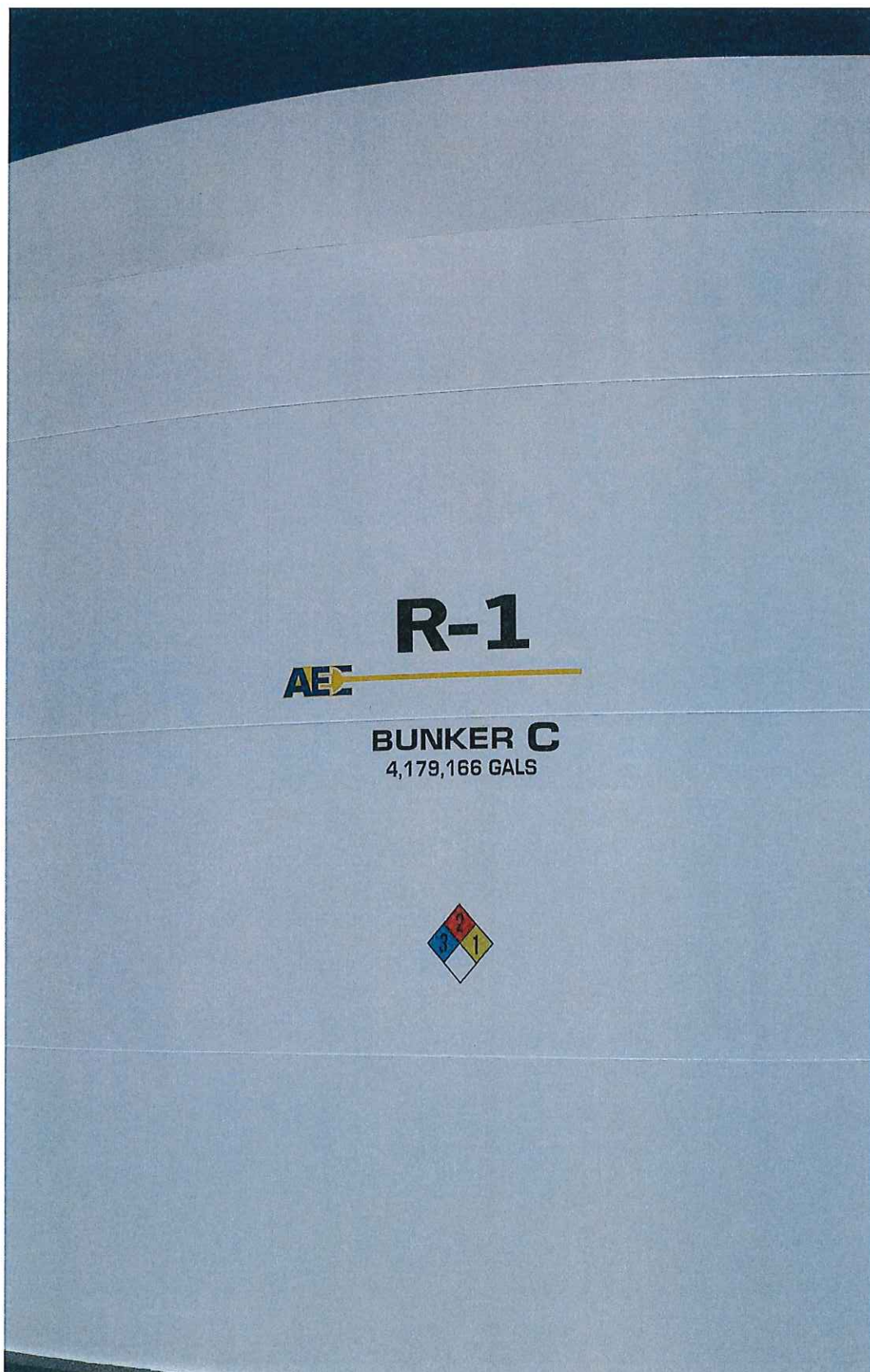
16" PULGADAS DE ANCHO X
 16" PULGADAS DE ALTO



4' PIES DE LARGO X 16" PULGADAS DE ALTO

R-1

Q- 11/sep/14
Final Approval





Colores para Líneas de Flujo

Colores para Líneas de Flujo	
Blanco	Bunker C, Light Oil
Amarillo	Hidrógeno, Gas Natural y Propano
Anaranjado	Ácido Sulfúrico concentrado, Amoniacó , Hidracina, Ciclohexalamina
Azul Claro	Soda cáustica
Rojo	Sistema Contra Incendio
Verde	Agua de caldera, planta de tratamiento, enfriamiento, desmineralizada, de pozo
Blanca	Agua de AAA--
Gris	Aceite de lubricación
Etiqueta negra y letras blancas (están insuladas)	Vapor

- En un tubo, entre una etiqueta y otra, no debe excederse los 25 pies, y éstas deben especificar la dirección del flujo.
- Se creará un PM para asegurar el cumplimiento del código de colores, tanto en los tanques como en las líneas.

PIPE MARKING GUIDE

to the ANSI/ASME A13.1 – 2007 Standard for the Identification of Pipes

COLOR CODE

Material Properties

Letter color on Field color

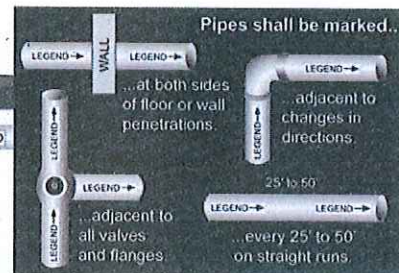
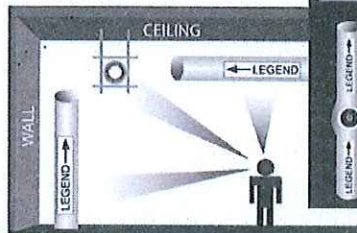
Example

FLAMMABLE Fluids which are a vapor or produce vapors that can ignite and continue to burn in air	Black on Yellow	→ HYDROGEN →
COMBUSTIBLE Fluids that may burn but are not flammable	White on Brown	→ ACETIC ACID →
TOXIC & CORROSIVE Fluids which are corrosive or toxic or will produce corrosive or toxic substances	Black on Orange	→ NITRIC ACID →
FIRE QUENCHING Water and other substances used in sprinkler fire-fighting piping systems	White on Red	→ HALON →
OTHER WATER Any other water, except for water used in sprinkler and fire-fighting piping systems	White on Green	→ BOILER WATER →
COMPRESSED AIR Any vapor or gas under pressure that does not fit a category above	White on Blue	→ COMPRESSED AIR →
DEFINED BY USER	White on Black	→ DEFINED BY USER →
DEFINED BY USER	Black on White	→ DEFINED BY USER →
DEFINED BY USER	White on Purple	→ DEFINED BY USER →
DEFINED BY USER	White on Gray	→ DEFINED BY USER →

PLACE MARKERS:

- To indicate direction of flow by labeling with arrows at one or both ends of the label
- To be visible from the point of normal approach
- Near valves, flanges and changes in pipe direction
- Both sides of ceiling, wall or floor penetrations
- At any line entry or re-entry point
- On straight pipe runs
- Every 50 feet

Right: Orientation of Labels



Above: Label placement in relation to point of normal approach

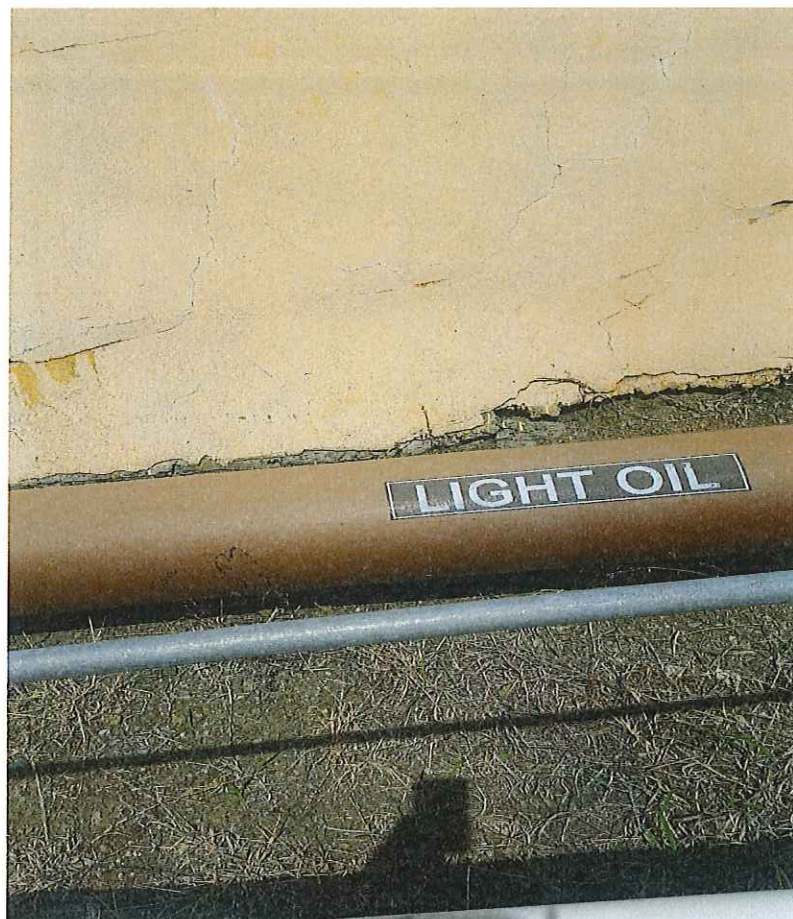
PIPE MARKER SIZE CHART

Letter and Label Dimensions in accordance with pipe diameter

Outside Pipe Diameter Including Covering	Minimum Length of Label Field Color	Minimum Height of Letters
.75" - 1.25" 19 - 32 mm	8" 203 mm	.5" 13 mm
1.5" - 2" 38 - 51 mm	8" 203 mm	.75" 19 mm
2.5" - 6" 64 - 152 mm	12" 305 mm	1.25" 32 mm
8" - 10" 203 - 254 mm	24" 610 mm	2.5" 64 mm
Over 10" Over 254 mm	32" 813 mm	3.5" 89 mm

NOTE: It is recommended that pipes less than .75" in diameter be labeled with a permanent tag.


This guide is for general purposes only. It is not a substitute for review of applicable standards.



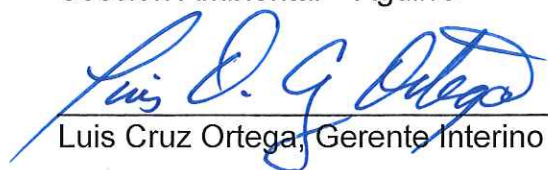
MIEMBROS CÓMITE CÓDIGO DE COLORES


Samuel A. Peña, Superintendente –
Extensión Vida Útil


Pedro A. Polanco, Químico
Jefe Asuntos Ambientales


Renecito Pabón, Jefe
Sección Ambiental – Aguirre


Rosa E. Feliciano, Supvr. Princ. Interina
Seguridad Ocupacional


Luis Cruz Ortega, Gerente Interino CASE



ASEGÚRATE



Seguimos con nuestra transformación de Seguridad y Salud Ocupacional. En este volumen mostramos el Código de Colores, para que vayas familiarizándote con el significado de cada color y el contenido de cada línea que transporte algún producto en tu área de trabajo. Para beneficio de todos, proveemos información sobre la Ley 16, nuestra responsabilidad y qué documentación tenemos que tener disponible ante cualquier visita de OSHA o auditoría de nuestros Oficiales de Seguridad a las diferentes dependencias de la Autoridad. Educándonos podemos hacer mejor nuestro trabajo. Adelante, ¡sigamos con nuestra Transformación por el bienestar de todos los que laboramos en la AEE!

Yenisa M. Salvá Huertas
Jefa de División
Seguridad Ocupacional

SEPTIEMBRE 2015, AÑO 6, VOLUMEN 9

Sabías que...

La Ley 16, conocida como Ley de Seguridad y Salud en el Trabajo de Puerto Rico está vigente desde el 5 de agosto de 1975. El propósito de esta ley es asegurar a todo empleado un lugar de trabajo libre de riesgos reconocidos a la salud y seguridad, minimizar los accidentes y las pérdidas.

Cuando existe una querrela realizada por un empleado o por un referido, un Inspector de OSHA en Puerto Rico, es el representante del Secretario del Departamento del Trabajo y tiene la facultad de realizar inspecciones en las áreas de trabajo, realizar entrevistas a empleados, tomar muestras y fotos para poder documentar dicha querrela. Este referido puede ser una noticia en algún periódico, radio o televisión, hasta la queja de algún vecino de la industria querrellada.

A su vez, todo supervisor, es el representante del patrono según está definido en la Ley, ya que éste ejerce autoridad sobre cualquier empleado. Así que es deber de todo patrono o supervisor cumplir con la Ley. Los supervisores son los llamados a documentar todo trabajo, gestión, coordinación y de proveer toda herramienta y equipo de protección personal que los empleados necesiten para cada tarea asignada por el supervisor.



En inspecciones realizadas por Inspectores de OSHA y por personal de nuestra División, se requiere una serie de documentos. A continuación, desglosamos cuáles son los documentos que debemos tener siempre disponibles. Estos son:

⇒ **Repaso breve del trabajo (job briefing)**- En ese documento debe estar escrito (a mano) cuál es el trabajo a realizar y la fecha en que se ofrece. Ejemplo: cambio de escobillas de la excitatriz #4. Cada parte de ese *job briefing* tiene que estar marcada, las cosas que apliquen. Las partes son: los riesgos asociados con ese trabajo específico, las precauciones especiales necesarias para el trabajo a realizar, el control de las fuentes de energía, el equipo de protección personal que va a usar cada empleado envuelto en esa tarea y los procedimientos o métodos de trabajo a utilizar. Todo *job briefing* tiene que estar firmado, en tinta azul, por el supervisor y los empleados.

⇒ **OSHA 300, 300A y 301** — Estos documentos los llena la oficina administrativa de cada área. Los Inspectores de OSHA usualmente piden de los últimos tres años y el año en curso hasta la fecha de la visita.

⇒ **Charlas de seguridad** — Cada mes, todo supervisor tiene que ofrecer una charla de seguridad de algún tema relevante, como podrían ser: productos químicos, equipos de protección personal, ruido, accidentes o incidentes ocurridos en las áreas de trabajo, y otros.

⇒ **Adiestramientos del personal** — Solo personal que haya sido adiestrado y esté cualificado para ciertas tareas puede realizar las mismas. Mantenga en el expediente del empleado todas las certificaciones y adiestramientos para evidenciar las cualificaciones de sus empleados.

⇒ **Certificaciones de equipos** — Todo elevador (carga y pasajeros), vasijas de presión, grúas de talleres, grúas *cherry pickers*, grúas de área de sargazo, vehículos de motor, jirafas, tijeras y otros equipos para levantar carga o personas tiene que tener su certificación anual vigente. Todo equipo de este tipo que esté involucrado en un incidente o accidente, ese certificado es una de las primeras cosas que pide un Oficial de Seguridad o Inspector de OSHA.

⇒ **Certificación de andamio y de quién lo instaló** — Solo personal adiestrado y cualificado podrá montar y certificar que un andamio está completo y disponible para usarse.

SIEMPRE que reciba la visita de un Inspector de OSHA, tiene que comunicarse a nuestra oficina, División de Seguridad Ocupacional, para asistirlo en la visita. Nuestro personal tiene vasta experiencia y le va a ayudar a manejar la situación y cumplir con la reglamentación.

RECUERDE nuestros teléfonos son:

(787) 521-4241, 4240, 4243... ¡a sus órdenes siempre!



¡MI FAMILIA ME ESPERA EN CASA, POR ESO ME PROTEJO Y ME CUIDO!

Charla de seguridad... Código de Colores



Recientemente la Autoridad estableció su Código de Colores, uniforme, para la identificación rápida de riesgos al trabajar en líneas que contengan algún producto. Esto nos sirve para reaccionar efectivamente durante una emergencia, y utilizar los equipos de protección necesarios para evitar exponernos a un producto que se encuentre almacenado en un tanque o una línea.

Además, cuando un empleado cambia de área de trabajo, o está prestado en algún área diferente a la suya, puede fácilmente reconocer los riesgos en el área, porque los colores serán los mismos en toda dependencia de la AEE.

Los equipos y estructuras que deben diferenciarse por el uso de colores son: tuberías, tanques y el sistema de protección contra incendio.

De acuerdo a OSHA, los colores que se utilizan son el rojo y el amarillo. El rojo se usa para indicar los sistemas de protección contra incendio, avisar la existencia de algún peligro (rótulos y recipientes de seguridad para productos inflamables como son los cilindros de hidrógeno), para indicar donde detenerse y para identificar el botón donde se desactiva una máquina. Además, el amarillo es el color que indica precaución.

OSHA adopta del *American National Standard Institute* (ANSI, por sus siglas en inglés), el uso de otros colores para identificar otros riesgos (ver tabla adjunta). ANSI, recomienda que en las tuberías se identifiquen las sustancias contenidas, escribiendo el nombre del contenido y la dirección del flujo. Esta identificación se colocará cerca de las válvulas, en las ramificaciones y donde la línea cambie de dirección. Además, deben ser colocadas en los puntos de mayor visibilidad, cada 25 pies de distancia, y siempre que una línea pase por una pared, debe estar rotulada en ambos lados de la pared, siempre con la dirección en que se mueve el flujo.

Les mostramos un ejemplo de como se colocarán las etiquetas en las líneas.



Acompañamos tabla de colores para las líneas de flujo y para que vayan relacionándose con éstas. En todas las Centrales se adoptarán los mismos colores por cada producto incluido.

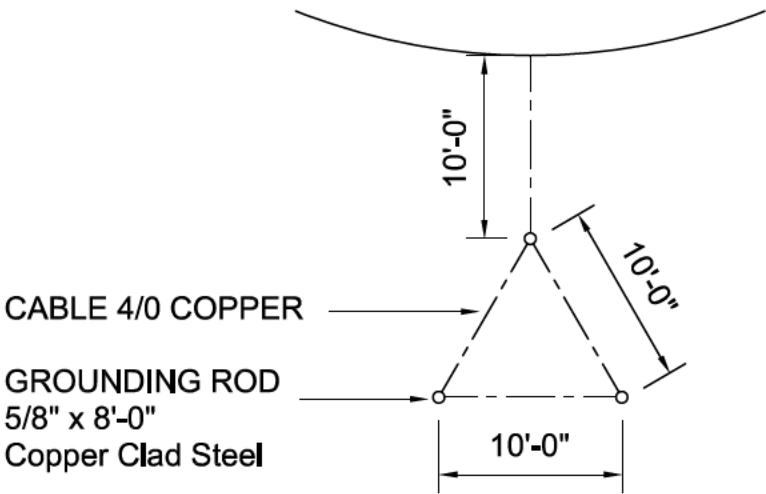
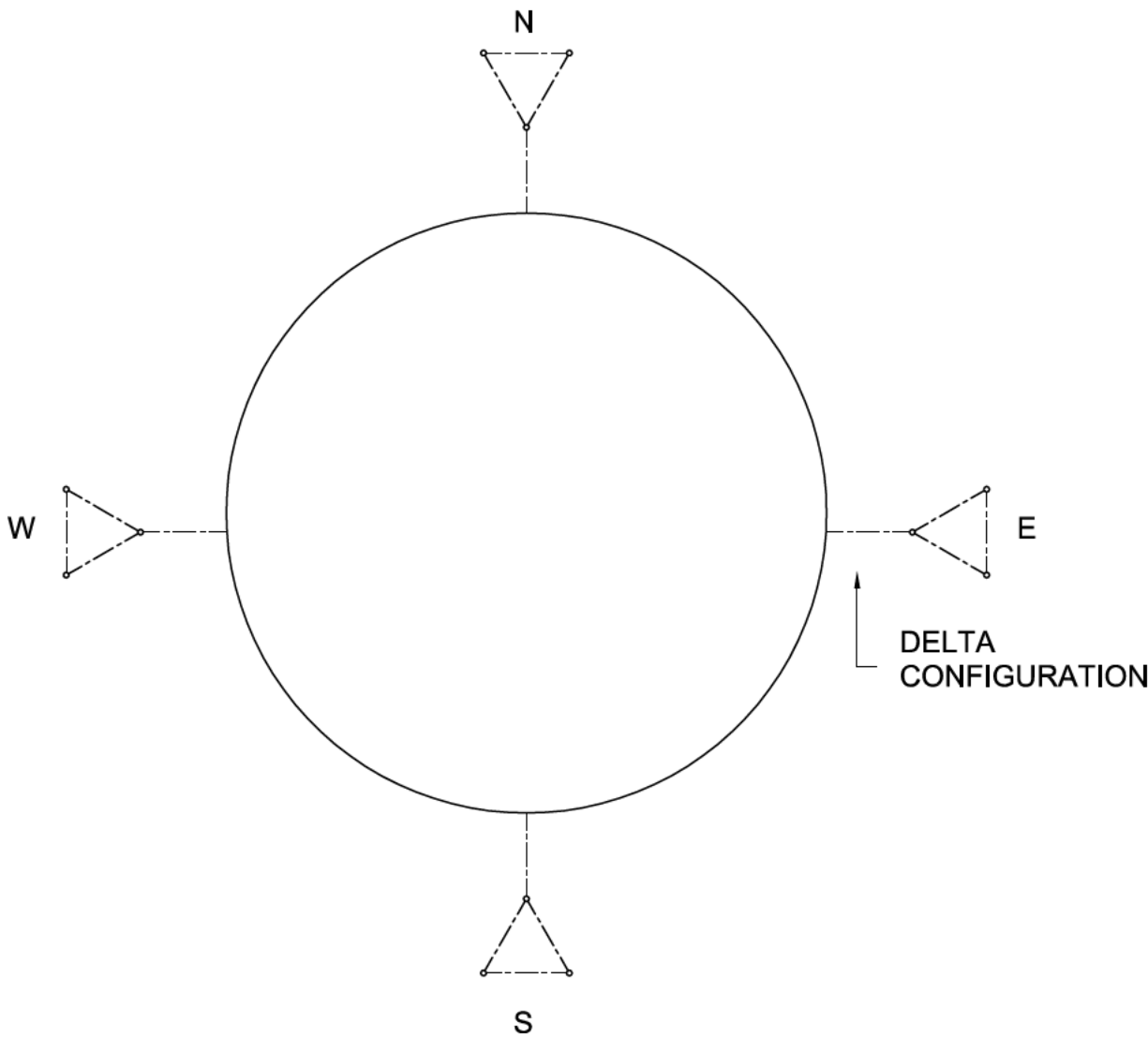
Colores para Líneas de Flujo	
Blanco	Bunker C, Light Oil
Amarillo	Hidrógeno, Gas Natural y Propano
Anaranjado	Ácido sulfúrico concentrado, Amoniaco, Hidracina, Ciclohexalamina
Azul Claro	Soda cáustica
Rojo	Sistema Contra Incendio
Verde	Agua de caldera, Planta de tratamiento, Agua desmineralizada, Agua de pozo y Agua de enfriamiento
Blanca	Agua de AAA
Gris	Aceite de lubricación
Etiqueta negra y letras blancas (líneas insuladas)	Vapor

Recuerda siempre verificar la hoja de datos de seguridad (SDS) para saber que equipo de protección necesitas usar al trabajar o exponerte a estos productos.



GENERAL GROUNDING DETAILS FOR TANKS

SCALE: 1/32"=1'-0"



DELTA DETAIL
SCALE 1/16"=1'-0"

DESIGNED _____	_____		ELECTRIC POWER AUTHORITY		
SURVEYED _____	_____		ENGINEERING DIVISION		
DRAWN _____	_____		GENERAL GROUNDING DETAILS FOR TANKS		
CHECKED _____	_____				
SUBMITTED _____	_____				
RECOMMENDED _____	_____		SCALE: AS SHOWN SAN JUAN, PUERTO RICO _____		
APPROVED _____	_____				

PREPA

San Juan Steam Plant, San Juan PR

Storage Tank TK-S10

Internal Visual and Ultrasonic Inspection Report

***Supplemental Inspections : Settlement Survey
MFE***

April 4, 2017

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1. TANK SPECIFICATIONS

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1. TANK SPECIFICATIONS

Erected by: El Dorado

Service = Bunker C

Year Built = 2002

Nom. Height = 30'-0"

Designed Liquid Level = 29'-00"

Nom. Diameter = 35'-0"

Nom. Capacity = 5,000 Bbls.

Specific Gravity = 1.00

Joint Efficiency = 1.00 (From Table 4.1)

Shell Courses Material:

1 To 4 = A-36

Roof = Unknown

Bottom = Unknown

Information was obtained from the nameplate.

2. SCOPE OF INSPECTION

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2- Scope of Inspection:

- An Ultrasonic A-scan thickness inspection was performed on the following items:
 - Bottom in a 9-points per plate pattern.
 - Bottom critical zone every feet. Approximately 3" from the shell course.
 - 3 readings were obtained at the header, one at each side and one at the top.
 - 3 readings were obtained at the header support, one at the front, one at the center and one at the back.
- A Magnetic Flux Exclusion (MFE) was performed to a 100% of the bottom plates for detection of soil side corrosion.
- Internal settlement readings were taken with the aid of a self leveling laser.
- An internal API 653 inspection was performed to this tank.

- Settlement Survey
 - Shell settlement measurements were taken in accordance with the guidelines of API Standard 653 Fifth Edition November 2014 Annex B.

- Technician(s):
 - Jorge Cotto API 653
 - Edwin Sanchez UT Lv II
 - Jose Morales UT, MFE Lv II
 - Neftali Rodriguez Lv I
 - David Castro Lv I

3. EXECUTIVE SUMMARY

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3- Executive Summary:

- The intent of this inspection is to verify the suitability for continued service of Storage Tank S10 Tank located at PREPA San Juan Steam Plant. The inspection consisted of API 653 internal inspection to all the components of the tank. Please refer to the scope of inspection for the description of the NDE performed at this tank, the UT machine used for this inspection was a 38DL plus. Settlement measurements were obtained with a self-leveling laser level and the MFE machine for the bottom plates scan was a Mark III.
- At the time of this inspection the outstanding findings are as follow: The overall condition of the coating should be evaluated by a NACE inspector to determined the extension of the repairs needed at this time. Two internal welds were noted with undercuts and bottom plate # 4 was found with mechanical damages that were marked for repairs with a 12"x24" welded-on plate. No relevant soil side indications were detected at the time of the MFE inspection.

4. FINDINGS, DISCUSSION & RECOMMENDATIONS

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4- Findings, Discussion & Recommendations:**4.1 General Observations**

The external inspection of this tank was previously performed, minor vegetation was noted at the dike area.

Recommendations

- A good housekeeping that includes trimming the vegetation should be maintained.
- The drain pumps of the dike should be tested by PREPA personnel to ensure their suitability for service.

4.2 Paint / Coating / Liners

The internal coating was found with several failures and inappropriate application.

Recommendations

- It is recommended that a certified NACE inspect the external & internal coating of the tank to determine the extension of repairs needed at this time.

4.3 Support Structure: Skirts, Legs, Saddles, Misc. Supports

The internal pipe supports were noted with coating failures; the manual level pipe support was found with a 0.250" long undercut.

Recommendations

- Repair the undercut following the guidelines provided at API standard 653 section 9.6.

4.4 Roof - Internal

This tank have a self supported cone roof. The roof internal components were observed from the bottom of the tank and were noted with severe coating failures and corrosion located at this failures.

Recommendations

- Properly clean the bottom side of the roof to remove all the corrosion, repair the welds as necessary and re-coat.

4.5 Shell - Internal

The internal side of the shell courses were noted to be protected with a coating that have several failures especially at the upper shell courses. No signs of major deteriorations were noted at the vertical or horizontal joints or the shell courses.

Recommendations

- It is recommended that a certified NACE inspect the external & internal coating of the tank to determine the extension of repairs needed at this time.

4.6 Bottom - Internal

The bottom plates coating was found with several failures. One area was marked for repairs at bottom plate # 4 due to a mechanical damage. No signs of major deteriorations were detected at the time of this inspection at the bottom plates or welds. No relevant soil side indications were detected at the time of the MFE inspection.

Recommendations

- Repair the area at bottom plate # 4 with a 12"x24" welded-on plate following the guidelines provided at API standard 653 section 9.3.

4.7 Man-ways, Nozzles, Reinforcement Pads, and Blinds**Shell nozzles (N#) and man-ways (Mw#):**

- N1 - 8"Ø = Coating Failures noted at the internal weld.
- N2 - 10"Ø = Coating Failures noted at the internal weld.
- N3 - 4"Ø = Coating Failures noted at the internal weld, we also noted a 0.500" undercut at this weld.
- N4 - 3"Ø = Coating Failures noted at the internal weld.
- N5 - 4"Ø = Coating Failures noted at the internal weld.
- N6 - 24"Ø = Coating Failures noted at the internal weld. The attached 16" header was also noted with coating failures at the supports.
- N7 - 4"Ø = Coating Failures noted at the internal weld.
- Mw 1 - 24"Ø = Coating Failures noted at the internal weld.
- Mw 2 - 24"Ø = Coating Failures noted at the internal weld.
- C1 - Thermo Coupling with coating failures at the internal weld.
- C2 - Externally plugged coupling with coating failures at the internal weld.

Roof nozzles (N#) and man-ways (Mw#): Observed from the interior of the tank.

Mw3 - Internal corrosion due to coating failure.

Recommendations

- **Shell nozzles**
 - Clean and re-coat all the nozzles, manways and the header supports.
 - Repair the undercut at N3 following the guidelines provided at API standard 653 section 9.6.
- **Roof nozzles**
 - Clean and re-coat all the nozzles and manways.

See Sk-02 locations.

4.8 Autogage System

The internal float was found in position with one of the guides bent.

Recommendations

- Replace the bent guide and re-position and calibrate once the repair at bottom plate # 4 is completed.

4.9 Additional Notes

The cathodic protection and the venting system of this tank should be evaluated to ensure proper service.
See attached documents for complete recommendations.

**ALL THE REPAIRS SHALL BE COMPLETED IN COMPLIANCE WITH THE CURRENT API STANDARD 653
AND INSPECTED IN ACOORDANCE TO SECTION 12 OF THE MENTIONED STANDARD**

5. INSPECTION CHECKLIST

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Visual Inspection Type: ☐ External ☒ Internal ☐ Limited External ☐ Limited Internal

Technician & Cert.: Edwin Sanchez UT Lv II

Supervisor & Cert.: Jorge Cotto API 653

5.1 General Observations

- A) Any signs of leakage: _____
- B) Nameplate condition: ☐ Missing ☐ Excellent ☐ Good ☒ Fair ☐ Poor ☐ Painted Over ☐ Not legible
- C) House Keeping (Product / Debris): ☐ Excellent ☐ Good ☒ Fair ☐ Poor
- D) Site Drainage: ☐ Excellent ☐ Good ☒ Fair ☐ Poor

Notes : The external inspection of this tank was previously performed, minor vegetation was noted at the dike area.

5.2 Paint / Coating / Liners (EXTERNAL / INTERNAL)

- A) General Condition: ☐ N/A ☐ Excellent ☐ Good ☐ Fair ☐ Poor ☒ Coating Failure
- B) Peeling, Flaking, Etc.: ☐ N/A ☐ Light ☐ Moderate ☐ Heavy ☒ Localized ☒ Uniform
- 1.) Paint Color: Tan

Notes : The internal coating was found with several failures and inappropriate application.

5.3 Support Structure: Skirts, Legs, Saddles, Misc. Supports (External / Internal)

- A) General Condition: ☐ N/A ☐ Excellent ☐ Good ☒ Fair ☐ Poor ☐ Need repair/replacement
- B) Pitting / Scale: ☒ None ☐ Localized ☐ Uniform ☐ Loose ☐ Tight
- C) Corrosion / Cracking: ☒ No attack ☐ Light ☐ Moderate ☐ Heavy ☐ Localized ☐ Uniform
- D) Attachment Welds: ☐ No attack ☒ Undercutting ☐ Below Flush ☐ Cracks ☐ Pitting ☐ Not Visible
- E) Paint: ☐ N/A ☐ Excellent ☐ Good ☐ Fair ☐ Poor ☒ Coating Failure
- F) Fire Proofing: ☒ N/A ☐ Excellent ☐ Good ☐ Fair ☐ Poor ☐ Need repair/replacement
- G) Fire Protection: ☒ N/A ☐ Excellent ☐ Good ☐ Fair ☐ Poor ☐ Need repair/replacement
- H) Structural Distortion: ☒ None ☐ Buckling ☐ Dents ☐ Bent ☐ Twisted ☐ Other (Explain below)

Notes : The internal pipe supports were noted with coating failures; the manual level pipe support was found with a 0.250" long undercut.

5.4 Roof - Internal

- A) General Condition: ☐ N/A ☐ Excellent ☐ Good ☒ Fair ☐ Poor ☐ Need repair/replacement
- 1.) Biological Growth: ☒ None ☐ Light ☐ Moderate ☐ Heavy ☐ Other (Explain below)
- B) Pitting / Scale: ☐ None ☐ Localized ☐ Uniform ☐ Loose ☐ Tight
- Measure Pit Size: Width, Length and Depth: _____
- C) Corrosion / Cracking: ☐ No attack ☐ Light ☐ Moderate ☐ Heavy ☒ Localized ☐ Uniform
- D) Attachment Welds: ☐ No attack ☐ Undercutting ☐ Below Flush ☐ Cracks ☐ Pitting ☒ Not Visible
- E) Erosion: ☐ None ☐ Around Nozzles ☐ Around Welds
- F) Structural Distortion: ☐ None ☐ Buckling ☐ Bulging ☐ Deformation ☐ Other (Explain below)

Notes : This tank have a self supported cone roof. The roof internal components were observed from the bottom of the tank and were noted with severe coating failures and corrosion located at this failures.

5.5 Shell - Internal

- A) General Condition: ☐ N/A ☐ Excellent ☐ Good ☐ Fair ☐ Poor ☒ Need repair/replacement
- 1.) Biological Growth: ☒ None ☐ Light ☐ Moderate ☐ Heavy ☐ Other (Explain below)
- B) Pitting / Scale: ☐ None ☒ Localized ☐ Uniform ☐ Loose ☐ Tight
- Measure Pit Size: Width, Length and Depth: _____
- C) Corrosion / Cracking: ☐ No attack ☐ Light ☐ Moderate ☐ Heavy ☒ Localized ☐ Uniform
- D) Attachment Welds: ☐ No attack ☐ Undercutting ☒ Below Flush ☐ Cracks ☐ Pitting ☐ Not Visible
- E) Erosion: ☐ None ☐ Around Nozzles ☒ Around Welds
- F) Structural Distortion: ☒ None ☐ Buckling ☐ Bulging ☐ Deformation ☐ Other (Explain below)

Notes : The internal side of the shell courses were noted to be protected with a coating that have several failures especially at the upper shell courses. No signs of major deteriorations were noted at the vertical or horizontal joints or the shell courses.

5.6 Bottom - Internal

- A) General Condition: ☐ N/A ☐ Excellent ☐ Good ☒ Fair ☐ Poor ☒ Need repair/replacement
- 1.) Biological Growth: ☒ None ☐ Light ☐ Moderate ☐ Heavy ☐ Other (Explain below)
- B) Pitting / Scale: ☐ None ☐ Localized ☐ Uniform ☐ Loose ☐ Tight
- Measure Pit Size: Width, Length and Depth:
- C) Corrosion / Cracking: ☐ No attack ☐ Light ☐ Moderate ☐ Heavy ☐ Localized ☐ Uniform
- D) Attachment Welds: ☒ No attack ☐ Undercutting ☐ Below Flush ☐ Cracks ☐ Pitting ☒ Not Visible
- E) Erosion: ☒ None ☐ Around Nozzles ☐ Around Welds
- F) Structural Distortion: ☒ None ☐ Buckling ☐ Bulging ☐ Deformation ☐ Other (Explain below)
- G) Annular Plate / Critical Zone: ☐ Buckling ☐ Deformation ☐ Corrosion ☐ Pitting ☐ Other (Explain below)

Notes : The bottom plates coating was found with several failures. One area was marked for repairs at bottom plate # 4 due to a mechanical damage.

No signs of major deteriorations were detected at the time of this inspection at the bottom plates or welds. No relevant soil side indications were detected at the time of the MFE inspection.

5.7 Man-ways, Nozzles, Reinforcement Pads, and Blinds

- A) General Condition: ☐ N/A ☐ Excellent ☐ Good ☒ Fair ☐ Poor ☐ Need repair/replacement
- B) Pitting / Scale: ☐ None ☒ Localized ☐ Uniform ☐ Loose ☐ Tight
- C) Corrosion / Cracking: ☒ No attack ☐ Light ☐ Moderate ☐ Heavy ☐ Localized ☐ Uniform
- D) Welds: ☐ No attack ☒ Undercutting ☐ Below Flush ☐ Leaks ☐ Cracks ☐ Pitting ☒ Not Visible
- E) Deficiencies: ☒ N/A ☐ Distorted ☐ Cracks ☐ Leaks
- F) Structural Distortion: ☒ None ☐ Buckling ☐ Dents ☐ Bent ☐ Twisted ☐ Other (Explain below)
- G) Weep Holes: ☐ None ☐ Plugged ☐ Open ☐ Leaking
- H) Erosion: ☒ No attack ☐ Light ☐ Moderate ☐ Heavy

Notes : Shell nozzles (N#) and man-ways (Mw#)

N1 - 8"Ø = Coating Failures noted at the internal weld.

N2 - 10"Ø = Coating Failures noted at the internal weld.

N3 - 4"Ø = Coating Failures noted at the internal weld, we also noted a 0.500" undercut at this weld.

N4 - 3"Ø = Coating Failures noted at the internal weld.

N5 - 4"Ø = Coating Failures noted at the internal weld.

N6 - 24"Ø = Coating Failures noted at the internal weld. The attached 16" header was also noted with coating failures at the supports.

N7 - 4"Ø = Coating Failures noted at the internal weld.

Mw 1 - 24"Ø = Coating Failures noted at the internal weld.

Mw 2 - 24"Ø = Coating Failures noted at the internal weld.

C1 - Thermo Coupling with coating failures at the internal weld.

C2 - Externally plugged coupling with coating failures at the internal weld.

Roof nozzles (N#) and man-ways (Mw#) Observed from the interior of the tank.

Mw3 - Internal corrosion due to coating failure.

5.8 Autogage System

- A) General Condition: ☐ N/A ☐ Excellent ☐ Good ☒ Fair ☐ Poor ☐ Need repair/replacement
- B) Pitting / Scale: ☒ None ☐ Localized ☐ Uniform ☐ Loose ☐ Tight
- C) Corrosion / Cracking: ☒ No attack ☐ Light ☐ Moderate ☐ Heavy ☐ Localized ☐ Uniform
- D) Attachment Welds: ☐ No attack ☐ Undercutting ☐ Below Flush ☐ Cracks ☐ Pitting ☒ Not Visible
- E) Paint: ☐ N/A ☐ Excellent ☐ Good ☐ Fair ☐ Poor ☒ Coating Failure

Notes : The internal float was found in position with one of the guides bent.

5.9 Additional Notes

Notes : The cathodic protection and the venting system of this tank should be evaluated to ensure proper service.

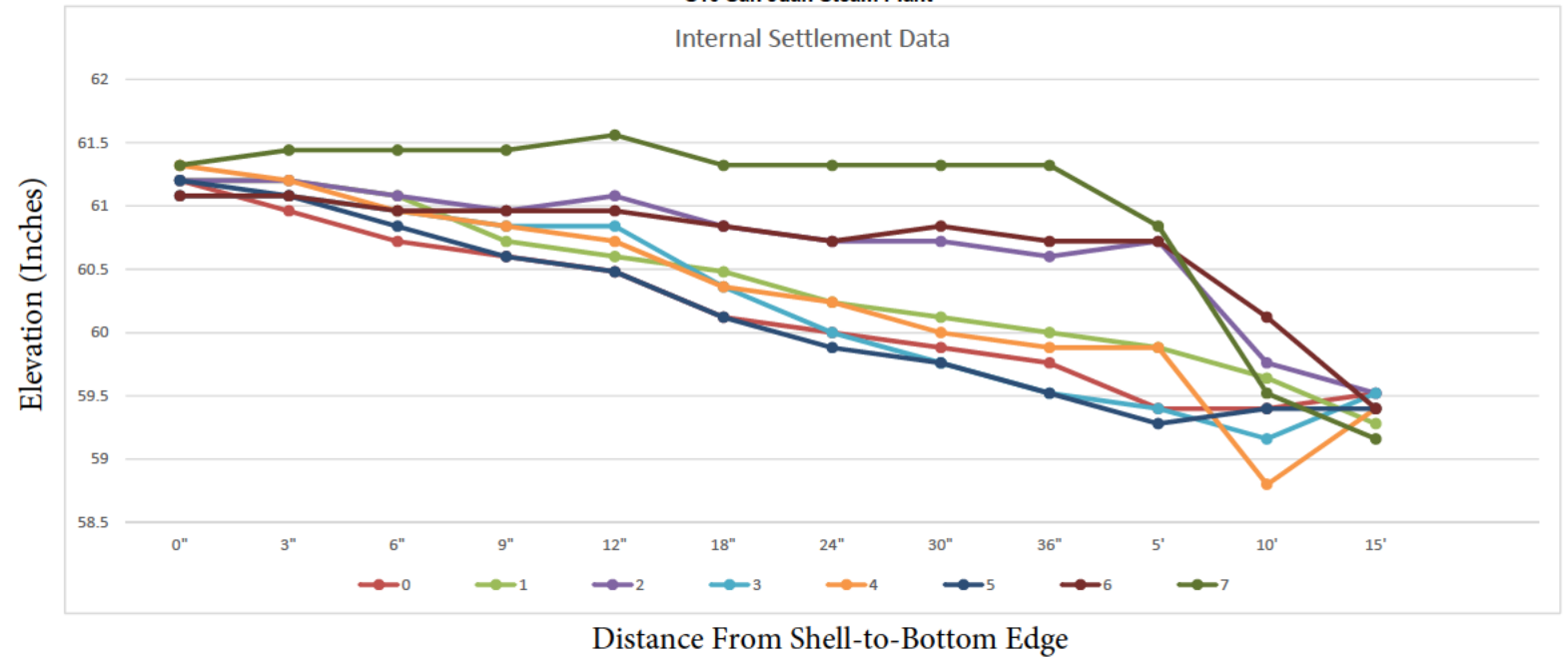
See attached documents for complete recommendations.

6. SETTLEMENT EVALUATION

- Internal Settlement
 - This evaluation was conducted to determine actual settlement condition of this Storage Tank in accordance with the API 653 Tank inspection Annex B guidelines. Based on the data gathered during the evaluation, no significant out of plane settlement or out of roundness was observed. Measurements did not exceed the acceptable limits nor damage to the internal shell or bottom plates.

INTERNAL SETTLEMENT EVALUATION
S10 San Juan Steam Plant

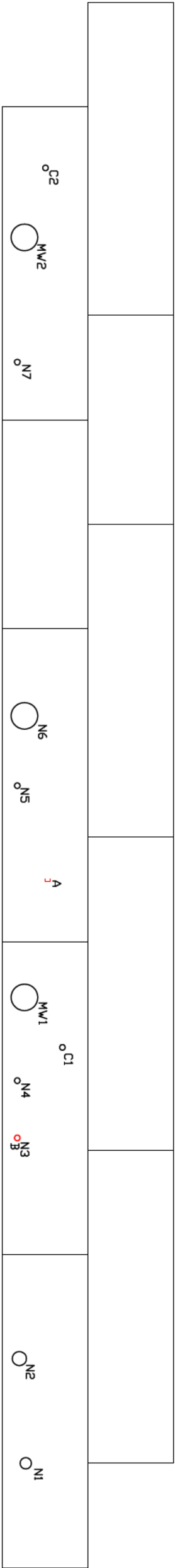
Internal Settlement Data



RADIAL LINE	0"	3"	6"	9"	12"	18"	24"	30"	36"	5'	10'	15'
0	61.20	60.96	60.72	60.60	60.48	60.12	60.00	59.88	59.76	59.40	59.40	59.52
1	61.20	61.20	61.08	60.72	60.60	60.48	60.24	60.12	60.00	59.88	59.64	59.28
2	61.20	61.20	61.08	60.96	61.08	60.84	60.72	60.72	60.60	60.72	59.76	59.52
3	61.08	61.08	60.96	60.84	60.84	60.36	60.00	59.76	59.52	59.40	59.16	59.52
4	61.32	61.20	60.96	60.84	60.72	60.36	60.24	60.00	59.88	59.88	58.80	59.40
5	61.20	61.08	60.84	60.60	60.48	60.12	59.88	59.76	59.52	59.28	59.40	59.40
6	61.08	61.08	60.96	60.96	60.96	60.84	60.72	60.84	60.72	60.72	60.12	59.40
7	61.32	61.44	61.44	61.44	61.56	61.32	61.32	61.32	61.32	60.84	59.52	59.16

7. DRAWINGS & FIELD REPORTS

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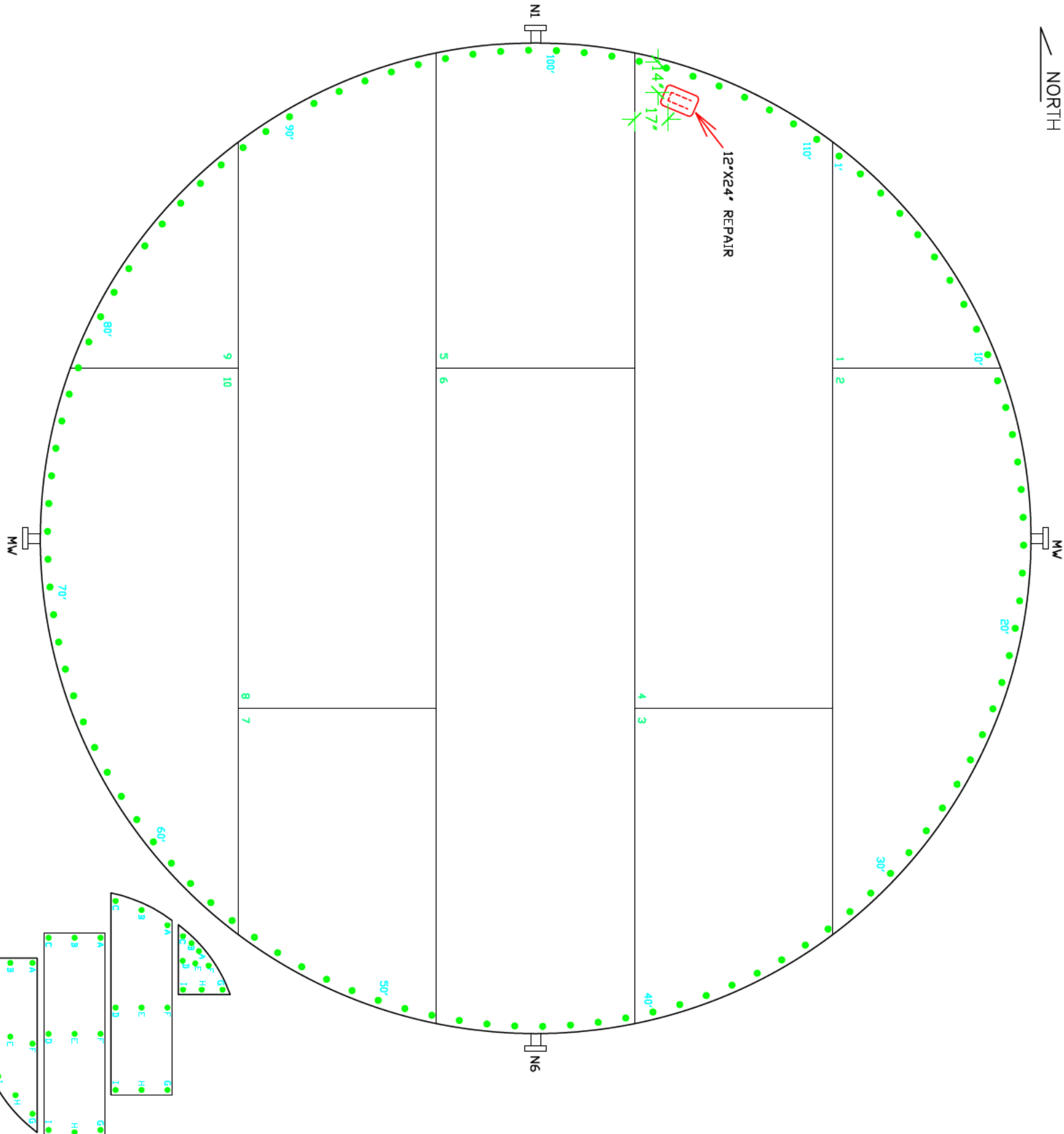
BOTTOM SHELL COURSES INTERNAL PLANAR VIEW

DESCRIPTION	
A	UNDERCUT AT PIPE SUPPORT WELD
B	UNDERCUT AT NOZZLE WELD

NOTE:

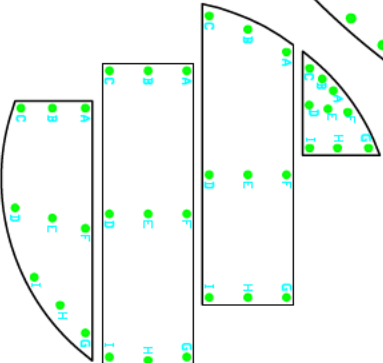
REPAIRS MUST BE COMPLETED FOLLOWING THE GUIDELINES AT API 653 SECTION 9.4.

DRAWN BY: JCH	DATE INSPECTED: 2/12/17	TK-S10 BOTTOM SHELL COURSES INTERNAL LAYOUT	PREPA SAN JUAN STEAM PLANT, SAN JUAN, P.R.	TEAM [®] Industrial Services, Inc
DATE DRAWN: 3/17	TECHNICIAN:			
SCALE: N.T.S.	DRAWING: 1 OF 5			
FILE NO:				



NOTE:
 = UT READINGS APPROXIMATELY 3" FROM ROOF EDGE. EACH READING IS 1' FROM THE PREVIOUS STARTING AT 1'.

TYPICAL UT LOCATIONS PER PLATE



FEET	UT
1	0.308
2	0.309
3	0.308
4	0.307
5	0.306
6	0.307
7	0.307
8	0.308
9	0.311
10	0.309
11	0.308
12	0.307
13	0.307
14	0.313
15	0.313
16	0.314
17	0.315
18	0.314
19	0.313
20	0.314
21	0.313
22	0.314
23	0.314
24	0.313
25	0.314
26	0.313
27	0.312
28	0.313
29	0.311
30	0.319
31	0.315
32	0.315
33	0.313
34	0.316
35	0.315
36	0.316
37	0.316

FEET	UT
38	0.314
39	0.315
40	0.315
41	0.314
42	0.313
43	0.305
44	0.305
45	0.308
46	0.311
47	0.309
48	0.311
49	0.309
50	0.308
51	0.307
52	0.306
53	0.305
54	0.304
55	0.309
56	0.309
57	0.300
58	0.305
59	0.308
60	0.308
61	0.310
62	0.311
63	0.311
64	0.312
65	0.309
66	0.308
67	0.308
68	0.308
69	0.305
70	0.314
71	0.315
72	0.315
73	0.316
74	0.317

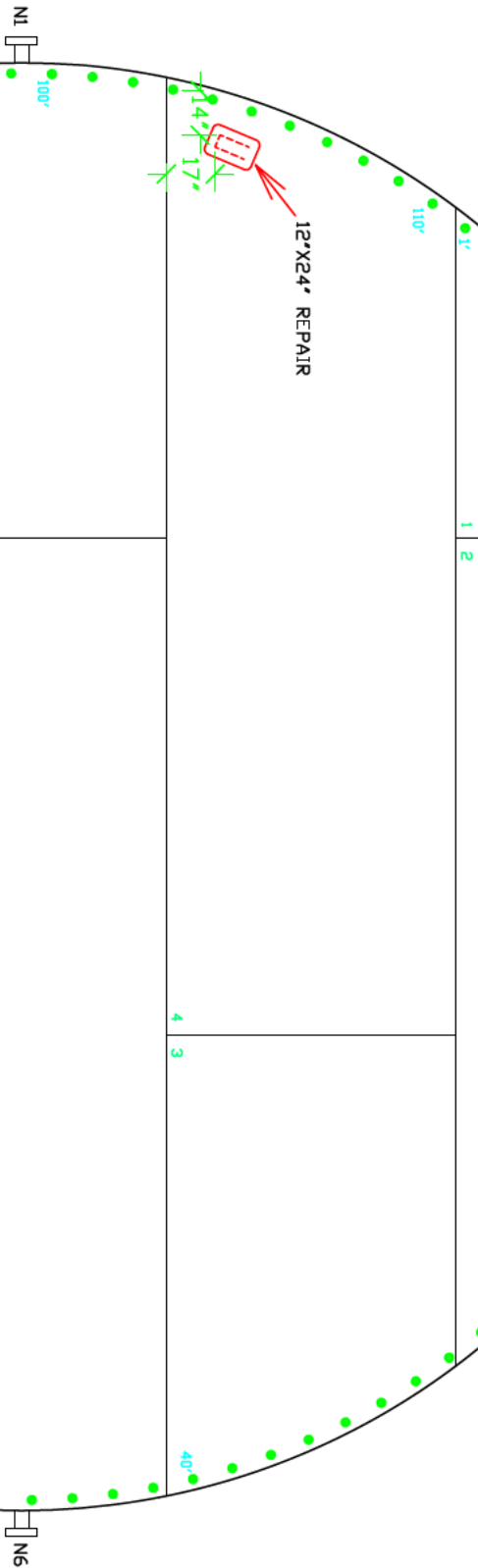
FEET	UT
75	0.316
76	0.316
77	0.315
78	0.314
79	0.313
80	0.315
81	0.316
82	0.313
83	0.315
84	0.313
85	0.314
86	0.316
87	0.315
88	0.338
89	0.339
90	0.314
91	0.316
92	0.315
93	0.312
94	0.316
95	0.318
96	0.317
97	0.309
98	0.308
99	0.310
100	0.310
101	0.308
102	0.308
103	0.309
104	0.309
105	0.323
106	0.309
107	0.309
108	0.307
109	0.306
110	0.308

ALL THICKNESS READINGS ARE IN INCHES

FLOOR UT READINGS

	A	B	C	D	E	F	G	H	I
PLATE 1	0.313	0.314	0.313	0.315	0.315	0.313	0.314	0.315	0.315
PLATE 2	0.314	0.315	0.311	0.313	0.315	0.312	0.314	0.312	0.313
PLATE 3	0.306	0.309	0.308	0.305	0.309	0.303	0.303	0.307	0.304
PLATE 4	0.308	0.312	0.308	0.307	0.309	0.307	0.307	0.308	0.307
PLATE 5	0.307	0.308	0.306	0.305	0.311	0.307	0.308	0.310	0.305
PLATE 6	0.306	0.309	0.304	0.308	0.311	0.307	0.306	0.309	0.306
PLATE 7	0.308	0.311	0.307	0.305	0.306	0.304	0.305	0.307	0.304
PLATE 8	0.308	0.310	0.306	0.308	0.310	0.306	0.308	0.310	0.305
PLATE 9	0.312	0.313	0.314	0.313	0.314	0.314	0.314	0.314	0.315
PLATE 10	0.312	0.314	0.313	0.315	0.316	0.312	0.317	0.314	0.314

FLOOR CRITICAL ZONE UT READINGS



DRAWN BY: JCH

DATE DRAWN: 4/17

SCALE: N.T.S.

DATE INSPECTED: 3/07/2017

TECHNICIAN:

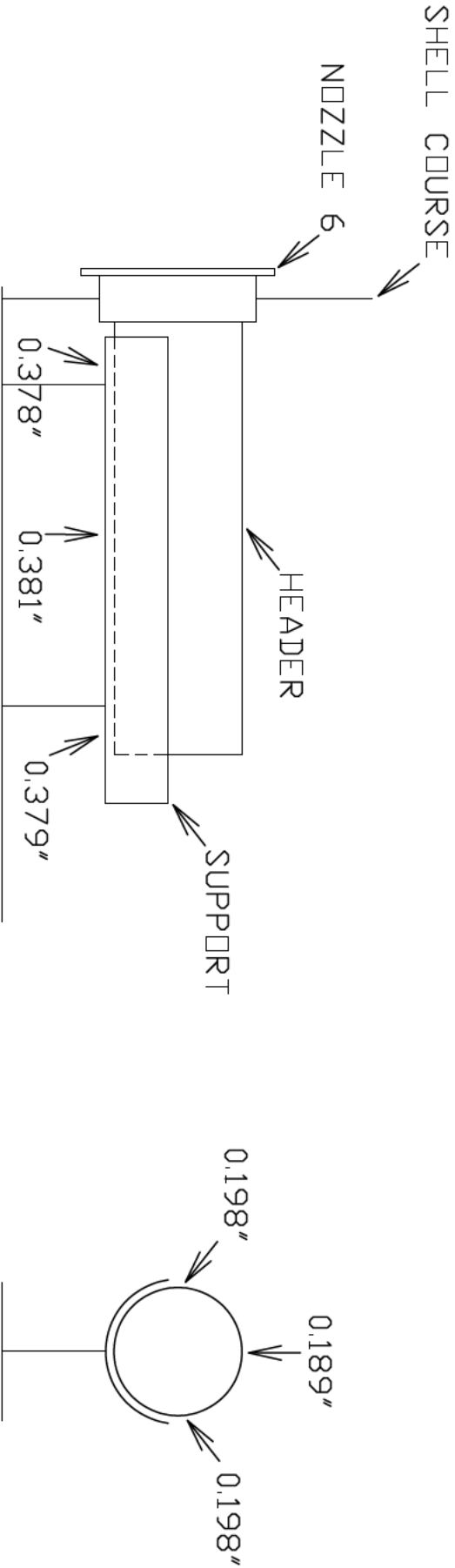
DRAWING: 2 OF 5

TK-S10
BOTTOM PLATES LAYOUT & UT
LOCATIONS

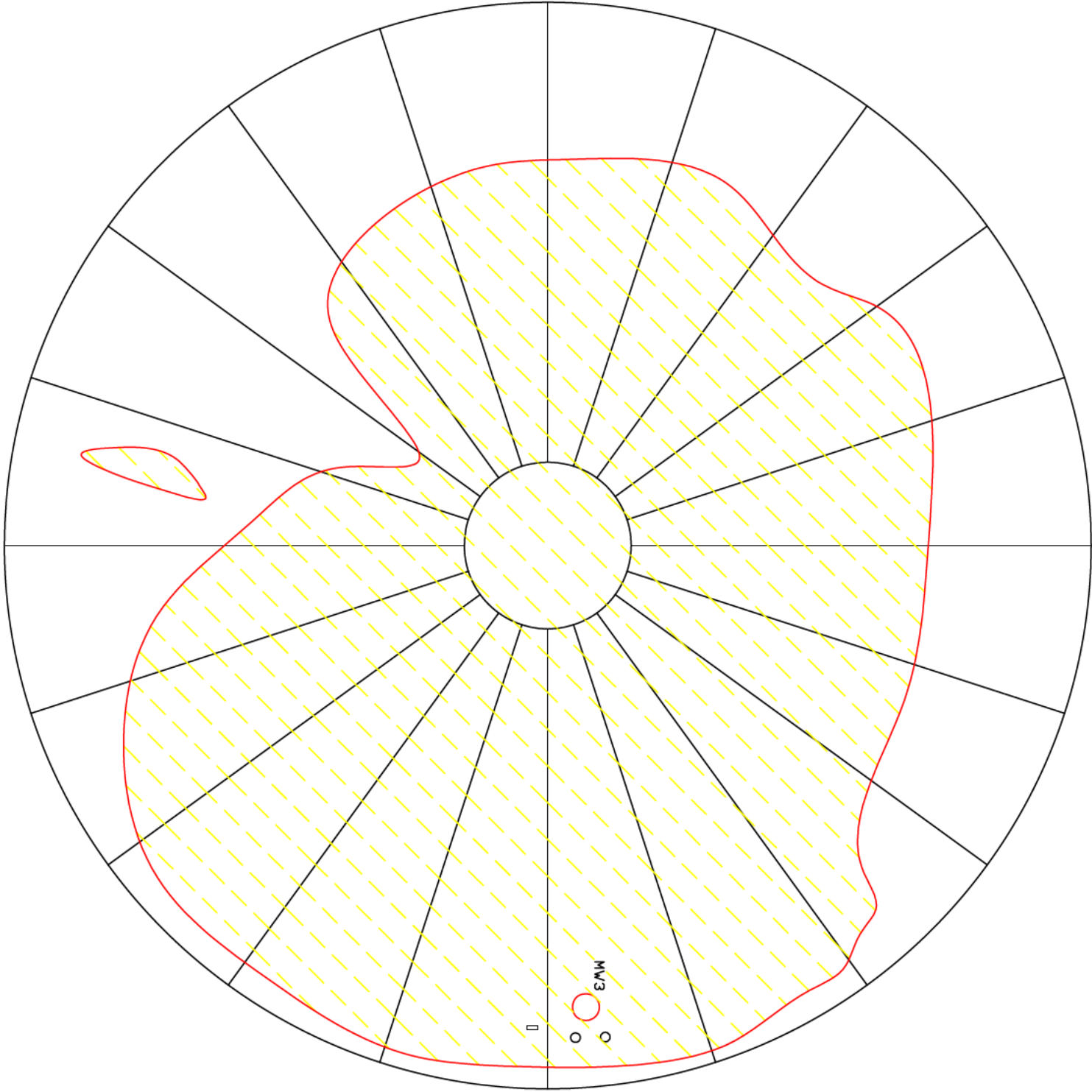
PREPA SAN JUAN STEAM
PLANT, SAN JUAN, P.R.

TEAM

Industrial Services, Inc



DRAWN BY: JCH	DATE INSPECTED: 3/07/2017	TK-S10 HEADER & SUPPORT UT	PREPA SAN JUAN STEAM PLANT, SAN JUAN, P.R.	TEAM® Industrial Services, Inc
DATE DRAWN: 4/17	TECHNICIAN:			
SCALE: N.T.S.				
FILE NO:	DRAWING: 3 OF 5			

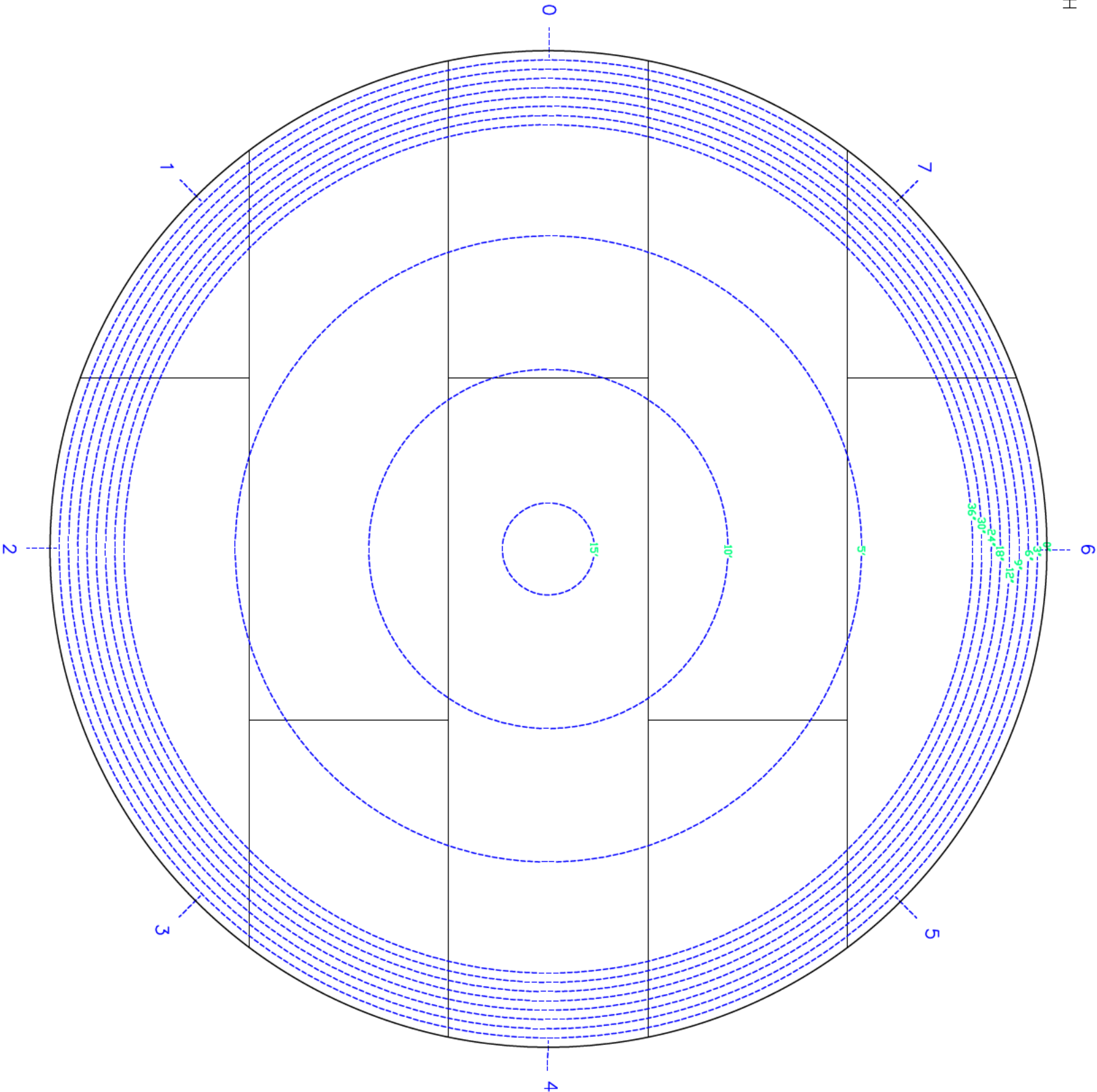


NOTE:

AREA IN YELLOW WAS NOTED WITH SEVERE COATING FAILURE.

DRAWN BY: JCH	DATE INSPECTED: 3/07/2017	TK-S10 ROOF PLATES LAYOUT	PREPA SAN JUAN STEAM PLANT, SAN JUAN, P.R.	TEAM [®] Industrial Services, Inc
DATE DRAWN: 4/17	TECHNICIAN:			
SCALE: N.T.S.				
FILE NO:	DRAWING: 4 OF 5			

← NORTH



NOTE:

THERE ARE EIGHT (8) SETTLEMENT COORDINATES WITH A DISTANCE OF 13.74 FT BETWEEN EACH.

DRAWN BY: JCH	DATE INSPECTED: 3/07/2017	TK-S10 INTERNAL SETTLEMENT POINTS LOCATIONS	PREPA SAN JUAN STEAM PLANT, SAN JUAN, P.R.	TEAM [®] Industrial Services, Inc
DATE DRAWN: 4/17	TECHNICIAN:			
SCALE: N.T.S.				
FILE NO:	DRAWING: 5 OF 5			

ULTRASONIC THICKNESS REPORT

Page: of

Customer Name: AEE - SAN JUAN P.R.

TEAM Job/WO No.: 18517018

Customer PO/WO:

Field Ticket No.:

Description: TANK S-10

Drawing No.: _____

Specification: _____ Procedure & Rev: _____ Acceptance: API 653

Test Results:

TECHNIQUE

Equipment: Mfg: OLYMPUS Model: 38DLWS Serial # 161358509 Cal Due: 8-15-17

Transducer Type: D790-SM Frequency: 5.0 MHz Size: 0.312" Serial # 1063715

Scan Mode: ☐ Std Mode ☒ Echo-to-Echo ☐ Pitch Catch ☐ Thru Coat ☐ EMAT Cable: Type/Length: 5'

Settings: Ref. Gain: 58 db Damping: — Reject: — Other: —

Direction of Scan: ☐ Top ☐ Bottom ☐ Side ☐ Other ☒ — Extent of Scan: THRU - DIST. TANK

Calibration Standard: 5 STEP CAL BLOCK Material: CS S/N: 105911

Calibration Standard: _____ Material: _____ S/N: _____

Surface Condition: _____ Couplant Mfg/Type: UTX GEL Batch # _____

<u>Actual Block Thickness</u>	<u>Instrument Reading</u>
1.0	1.0
1.1	1.1
1.2	1.2
1.3	1.3
1.4	1.4
1.5	1.5
1.6	1.6
1.7	1.7
1.8	1.8
1.9	1.9
2.0	2.0
2.1	2.1
2.2	2.2
2.3	2.3
2.4	2.4
2.5	2.5
2.6	2.6
2.7	2.7
2.8	2.8
2.9	2.9
3.0	3.0
3.1	3.1
3.2	3.2
3.3	3.3
3.4	3.4
3.5	3.5
3.6	3.6
3.7	3.7
3.8	3.8
3.9	3.9
4.0	4.0
4.1	4.1
4.2	4.2
4.3	4.3
4.4	4.4
4.5	4.5
4.6	4.6
4.7	4.7
4.8	4.8
4.9	4.9
5.0	5.0
5.1	5.1
5.2	5.2
5.3	5.3
5.4	5.4
5.5	5.5
5.6	5.6
5.7	5.7
5.8	5.8
5.9	5.9
6.0	6.0
6.1	6.1
6.2	6.2
6.3	6.3
6.4	6.4
6.5	6.5
6.6	6.6
6.7	6.7
6.8	6.8
6.9	6.9
7.0	7.0
7.1	7.1
7.2	7.2
7.3	7.3
7.4	7.4
7.5	7.5
7.6	7.6
7.7	7.7
7.8	7.8
7.9	7.9
8.0	8.0
8.1	8.1
8.2	8.2
8.3	8.3
8.4	8.4
8.5	8.5
8.6	8.6
8.7	8.7
8.8	8.8
8.9	8.9
9.0	9.0
9.1	9.1
9.2	9.2
9.3	9.3
9.4	9.4
9.5	9.5
9.6	9.6
9.7	9.7
9.8	9.8
9.9	9.9
10.0	10.0

1) <u>0.100"</u>	1) <u>0.101"</u>
2) <u>0.200"</u>	2) <u>0.201"</u>
3) <u>0.300"</u>	3) <u>0.301"</u>
4) <u>0.400"</u>	4) <u>0.401"</u>
5) <u>0.500"</u>	5) <u>0.501"</u>

Initial Calibration:

Periodic Check:

Final Check:

Calibration Times

Time	<u>9:30 am</u>	% Error	_____
Time	<u>11:00 am</u>	% Error	_____
Time	<u>1:00 pm</u>	% Error	_____
Time	<u>3:00 pm</u>	% Error	_____
Time		% Error	_____

[illegible]

Sketch

Limitations:

Remarks:

Technician: Edwin Sanchez

PRINT NAME _____

SIGNATURE

LEVEL

CERTIFICATION
EXPIRATION DATE

DATE _____



ULTRASONIC THICKNESS REPORT

Page: _____ of _____

Customer Name: AEE - SAN JUAN PRTEAM Job/WO No.: 18517013

Customer PO/WO: _____

Field Ticket No.: _____

Description: TANK S-10

Drawing No.: _____

Specification: _____ Procedure & Rev: _____ Acceptance: API 653

Test Results: _____

TECHNIQUE

Equipment: Mfg: OLYMPUS Model: 38NDPWS Serial # 161358509 Cal Due: 8-15-17Transducer Type: D790-SM Frequency: 5.0 MHz Size: 0.312" Serial # 1063715Scan Mode: ☐ Std Mode ☒ Echo-to-Echo ☐ Pitch Catch ☐ Thru Coat ☐ EMAT Cable: Type/Length: 5'Settings: Ref. Gain: 58db Damping: - Reject: - Other: _____Direction of Scan: ☐ Top ☐ Bottom ☐ Side ☐ Other - Extent of Scan: THRU-OUT TANKCalibration Standard: 5 STEP CAL BLOCK Material: CS S/N: 105916

Calibration Standard: _____ Material: _____ S/N: _____

Surface Condition: _____ Couplant Mfg/Type: UTX GEL Batch # _____

Actual Block Thickness		Instrument Reading		Calibration Times		
1)	<u>0.100"</u>	1)	<u>0.100"</u>	Initial Calibration:	Time <u>9:00am</u>	% Error _____
2)	<u>0.200"</u>	2)	<u>0.200"</u>	Periodic Check:	Time <u>11:20am</u>	% Error _____
3)	<u>0.300"</u>	3)	<u>0.300"</u>		Time <u>1:30pm</u>	% Error _____
4)	<u>0.400"</u>	4)	<u>0.400"</u>		Time <u>3:15pm</u>	% Error _____
5)	<u>0.500"</u>	5)	<u>0.500"</u>	Final Check:	Time _____	% Error _____

Spot No.	Gauge Reading	Spot No.	Gauge Reading	Sketch	
				SEE ATTACHMENTS	
				SEE ATTACHMENTS	

Limitations: _____

Remarks: _____

Technician: Edwin Sanchez ES

PRINT NAME

SIGNATURE

II
LEVEL7-15-17
CERTIFICATION
EXPIRATION DATE3-8-17
DATE

8. CALCULATIONS

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8. CALCULATIONS

▪ **8.1 Formula & Minimum Required Thickness Estimation**

- **For the minimum thickness the formula used was obtained from API Standard 653 Fourth Edition, April 2009 Addendum 2 (2012) Sec. 4.3.3.1**

$$T_{min} = \frac{2.6 (H-1)DG}{SE}$$

H = the height from the bottom of the shell course under consideration to the maximum liquid level when evaluating an entire shell course, in feet.

D = the nominal diameter of the tank, in feet

G = the highest specific gravity of the content

S = the maximum allowable stress in pound force per square inch

E = the original joint efficiency of the tank

For this Tank:

D = 35'-0" (From Nameplate)

G = 1 (From Nameplate)

E = 1.0 (From API 653 Table 4.2 for Basic Standard)

S = 24,900 for lower courses, 27,400 for upper courses (From API Standard 653 Table 4.1)

H = 29'-0" (Designed Liquid Level from Nameplate)

Construction Yr. = 2002 (From Nameplate)

▪ **8.2 Bottom**

Corrosion Rate

0.3125" Nominal Thickness-From previous report of similar tank TK-DR1

0.300" actual lower thickness reading obtained at the time of this inspection

15 years in service

$0.3125 - 0.300 = 0.0125 = 12.5 \text{ mils}$

12.5 divided by 15 equals 0.833 mils per years

Remaining Life

0.300" actual lower thickness reading obtained at the time of the inspection

0.100" minimum required thickness (obtained from API Standard 653 Table 4.4)

0.833 mils per year (corrosion rate)

$$\frac{0.300 - 0.100}{(0.833)}$$

$0.300 - 0.100 = 0.200 = 200 \text{ mils}$

$$\frac{200}{0.833}$$

Remaining life = Over 20 years

▪ **8.3 Bottom Next Inspection Interval Evaluation**

$$MRT = (\text{Minimum of } RT_{bc} \text{ or } RT_{ip}) - Or (StPr + UPr)$$

$$MRT = 0.100$$

$$RT_{bc} = 0.300 \text{ (Bottom Side Remaining Wall, Detected after MFE Inspection)}$$

$$RT_{ip} = 0.300 \text{ (Top Side Remaining Wall after Repairs)}$$

$$StPr = (0.3125 - 0.300) \% 15 \text{ Yrs} = 0.001$$

$$UPr = (0.3125 - 0.300) \% 15 \text{ Yrs} = 0.001$$

$$MRT = (RT_{bc}) - Or (StPr + UPr)$$

$$0.300 - 20 (0.001 + 0.001)$$

$$0.300 - 0.040$$

$$= 0.260$$

$$MRT = (RT_{ip}) - Or (StPr + UPr)$$

$$0.300 - 20 (0.001 + 0.001)$$

$$0.300 - 0.040$$

$$= 0.260$$

The results are greater than the minimum required thickness therefore the tank can operate for the proposed 20 years.

9. INSPECTION FREQUENCY AND OWNER RESPONSIBILITIES

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9. INSPECTIONS FREQUENCY AND OWNER RESPONSIBILITIES

Inspection frequency considerations as defined by API Standard 653, Section 6, paragraph 6.2.1, 6.2.2 and 6.2.3. The inspection intervals and extent listed for routine in-service inspections are defined in API Standard 653 Section 6.3.1. These inspections can be performed by personnel who are familiar with the storage facility operations and product stored. Inspection intervals for external inspections are listed in API Standard 653 Section 6.3.2. These inspections are to be performed by authorized inspectors at an interval not to exceed 5 years or $RCA/4N$ years (where RCA is the difference between the measured shell thickness and the minimum required thickness in mils, and N is the shell corrosion rate in mils per year) whichever is less. Inspection intervals for ultrasonic thickness inspection are listed in API Standard 653 Section 6.3.3.2:

a) When the corrosion rate is not known, the maximum interval shall be five years. Corrosion rates may be estimated from tanks in similar service based on thickness measurements taken at an interval not exceeding five years.

b) When the corrosion rate is known, the maximum interval shall be the smaller of $RCA/2N$ years (where RCA is the difference between the measured shell thickness and the minimum required thickness in mils, and N is the shell corrosion rate in mils per year) or 15 years.

Inspection intervals for internal inspections are listed in API Standard 653 Section 6.4.2.1. The interval from initial service date until the first internal inspection shall not exceed 10 years unless a tank has one or more of the leak prevention, detection, corrosion mitigation or containment safeguards listed in Table 6.1. The initial internal inspection date shall be based on incremental credits for the additional safeguards in Table 6.1 which are cumulative. In addition to inspection frequency considerations the owner/operator is required to maintain a complete record consisting of inspection history, construction records, and repair/alteration history.

*TABLE 6 INSPECTION INTERVALS FOR TANK

Type of Inspection

The Scheduled External Inspection, by a Qualified Inspector was scheduled to be performed on 2019 after the 2014 Inspection

The In-service UT Thickness Survey was scheduled to be performed on 2023 after the 2014 Inspection

Recommended Inspection Interval

Scheduled Internal Inspection & Out-service UT Thickness Survey 20 yrs

Intervals are based on the completion of all the repairs and post inspections.

Prepared by:

Jorge D. Cotto

API 653 Cert: 31290

10. PHOTOS

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NN1 Internal View



Internal Shell-to-Bottom Weld



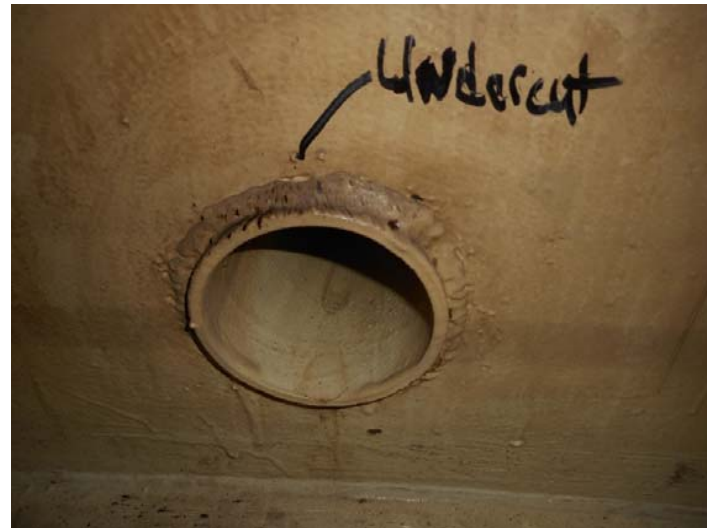
Internal Shell Courses



Coating Failures at N2



Internal Shell-to-Bottom Weld



Undercut at N3



Innapropriate Application of Coating



N4 Internal View



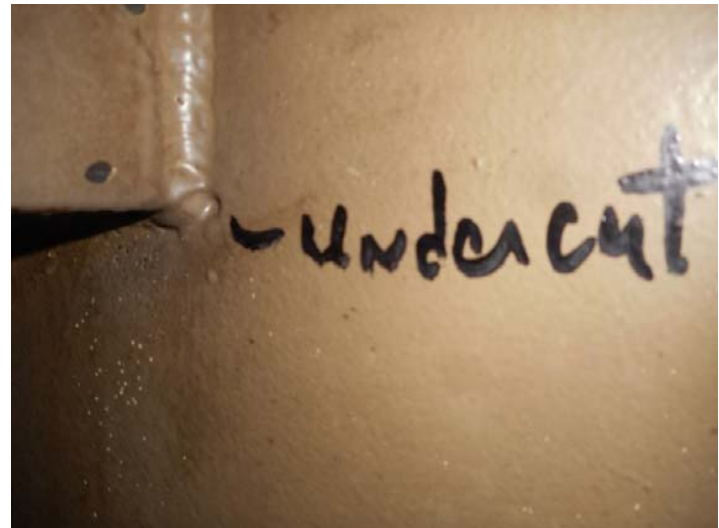
Thermo Couple



Manway Coating Failures



Internal Pipe & Support



Undercut at Pipe Support



Coating Failure at Internal Pipe



Shell Courses Coating



Coating Failures at N5



Coating Failures at N6



Header at N6



Header at N6



Header Support with Coating Failures



Header Support with Coating Failures



Innapropriate Application of Coating



Coating Failure at Vertical Weld



Coating Failures at N7



Coating Failures at Manway



Coupling



Coating Failures at Shell Courses



Bottom Plates



Recommended Repair at Bottom Plate # 4



Bottom Plates



Coating Failure at Bottom Plate's Weld



Innapropriate Application of Coating



Innapropriate Application of Coating



Corrosion at Roof Bottom Side



Level Alarm Float



Internal Pipe



Corrosion at Roof Bottom Side



Automatic Level Gauge Float with Bent Guide



Coating Failure at Shell Course3

11. CERTIFICATIONS

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API Individual Certification Programs

certifies that

Jorge David Cotto

has met the requirements to be a certified

*API-653 Aboveground Storage Tank
Inspector*

Certification Number *31290*

Original Certification Date *October 31, 2007*

Current Certification Date *October 31, 2016*

Expiration Date *October 31, 2019*

Tina Briskin

Manager, Individual Certification Programs



*This is a copy the original has gold foil typeset To verify authenticity
please go to <http://myicp.api.org/inspectorsearch/> and follow instructions
to verify inspectors status*

2015-027 | PDF

TEAM[®] Industrial Services
Personnel Qualification and Certification

Employee Name: Edwin E. Sanchez

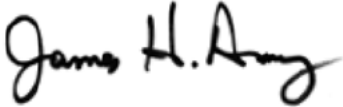
Employee ID#: 908445

Vision Acuity Expiration Date: 6/16/2017

METHOD	LEVEL	DATE CERTIFIED	EXPIRATION DATE	GENERAL-III METHOD-III SCORE	SPECIFIC SCORE	PRACTICAL SCORE	COMPOSITE SCORE %	EXPERIENCE HOURS	TRAINING HOURS	LIMITED TO	COMMENTS
AR/RT	N/A	2/18/2014		N/A	N/A	N/A	N/A	N/A	N/A		
UT	II-L	7/15/2014	7/15/2017	86	93	88	89	2728	160	A- Scan Thickness	
VT	II	6/16/2015	6/16/2018	82	85	98	88	369	24		

The above named individuals qualification history has been reviewed and found to be acceptable IAW TEAM's requirements for certification; 33.G.103-S1, SNT-TC-1A-2011 and earlier editions (1992, 2001 and 2006), as published by the American Society for Nondestructive Testing and/or any additional certification standards listed in the comments section above.

Certifying Authority:



Date:

6/18/2015

James H. Amy
Corporate Level III
ASNT/ACCP Cert # 28182

TEAM[®] Industrial Services

Personnel Qualification and Certification

Employee Name: Jose Morales Prado

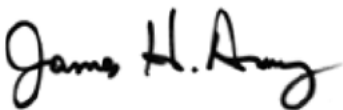
Employee ID#: 904320

Vision Acuity Expiration Date: 6/17/2017

METHOD	LEVEL	DATE CERTIFIED	EXPIRATION DATE	GENERAL-VII METHOD-III SCORE	SPECIFIC SCORE	PRACTICAL SCORE	COMPOSITE SCORE %	EXPERIENCE HOURS	TRAINING HOURS	LIMITED TO	COMMENTS
MT	II-L	6/16/2015	6/16/2018	85	70	94	83	2950	24	Yoke	
PT	II	6/16/2015	6/16/2018	92	83	92	89	3050	16		
VT	II	6/16/2015	6/16/2018	72	95	95	87	3450	24		
UT	II-L	6/17/2015	6/17/2018	93	93	93	93	3450	64	A- Scan Thickness	Recert by Letter: 07/11/2015

The above named individuals qualification history has been reviewed and found to be acceptable IAW TEAM's requirements for certification; 33.C.103-S1, SNT-TC-1A-2011 and earlier editions (1992, 2001 and 2006), as published by the American Society for Nondestructive Testing and/or any additional certification standards listed in the comments section above.

Certifying Authority:



Date:

7/13/2015

James H. Amy
Corporate Level III
ASNT/ACCP Cert # 28182

PUERTO RICO ELECTRIC POWER AUTHORITY
EXECUTIVE DIRECTORATE

REQUISITION NUMBER 224321

SAN JUA STEAM PLANT
FUEL OIL #6 SERVICE TANK S-10 REHABILITATION

APPEAR

AS FIRST PARTY: The Puerto Rico Electric Power Authority (PREPA), a public corporation and government instrumentality of the Government of Puerto Rico, created by Act of May 2, 1941, No. 83, as amended, represented in this act by its Chief Executive Officer/Executive Director, José F. Ortiz Vázquez, of legal age, married and resident of San Juan, Puerto Rico.

AS SECOND PARTY: [contractor's name] (Contractor), a [partnership or corporation] organized and existing under the laws of [State], authorized to do business in Puerto Rico, represented in this act by its [title], [name], of [legal status], and resident of [domicile], by virtue of [document that certifies representative powers] dated as [effective document date].

WITNESSETH

WHEREAS, PREPA, by virtue of its enabling act, Act 83 of May 2, 1941, as amended (Act 83), has the authority to engage those professional, technical and consulting services necessary and convenient to the activities, programs, and operations of PREPA;-----

WHEREAS, as established in Section 205 (1) of Act 83, all purchases and contracts for supplies or services, except personal services, made by PREPA, including its capital construction contracts, shall be made by calling for bids with sufficient time before the date the bids are opened so that PREPA can guarantee proper knowledge and appearance of competitive bidders; -----

WHEREAS, this Contract was awarded to the Contractor on [INSERT DATE] by means of a bid process [INSERT BID PROCESS NUMBER]. -----

THEREFORE, in consideration of the mutual covenants hereinafter stated, the Parties hereby agree to execute the Contract as follows: -----

ARTICLE 1. Scope of Contract

The Contractor shall furnish all labor, materials, equipment, tools, supervision, test and permits for the San Juan Power Plant Service Tank S-10 Rehabilitation in strict accordance with the provisions of this Contract, including the General Conditions, Special Conditions, Proposal Forms, Contractor's Bidding Proposal, and reference drawings, all of which are hereby made a part hereof (Services). Provided that, on or before the term of this Contract is expired the Contractor shall deliver to PREPA a true and exact copy of all diagrams, plans, sketches, maps, and other documents used in the performance of Services and for which a third party copyright or patent right would not be an impediment for such delivery. -----

ARTICLE 2. Definitions

Whenever the words defined in this article or pronouns used instead they shall have the meanings here given: -----

2.1 Act of God – is construed herein to mean an earthquake, hurricane or other cataclysmic phenomenon of nature not ordinarily occurring. Rains, windstorms, floods or other natural phenomenon of normal intensity for the particular locality as determined by the preceding five (5) year monthly average from records of the nearest National Oceanic and Atmospheric Administration recording station shall not be construed as an Act of God. -----

2.2 Applicable Law – shall mean any federal, state or local act, statute, law, code, rule, regulation or order applicable to Contractor's performance of the work.-----

2.3 Calendar Day – shall mean every 24-hour day shown on the calendar, beginning and ending at midnight. -----

2.4 Completion Date – date in which all tasks and project scope had completed.-----

2.5 Contracting Officer- shall mean PREPA's Chief Executive Officer, acting directly or through his properly authorized agents.-----

2.6 "Contract"- shall mean, collectively, all the covenants, terms, and stipulations in these articles of agreement and in all supplementary documents hereto attached which constitute essential parts of the Contract and are hereby made part thereof, to wit:-----

- a. Contract
- b. Invitation to Bid and Advertisement for Bids
- c. Instruction to Bidders

- d. Special Conditions and Drawings
- e. Technical Specifications
- f. Proposal Forms
- g. Performance and Payment Bonds
- h. Letter of Award
- i. Contractor's Bid Proposal dated [INSERT DATE] including Bid Data and Schedules

Except as otherwise provided in this Contract, if any provision contained in Contractor's Proposal dated [INSERT DATE] is in conflict with the terms and conditions of the Contract, the terms and conditions of the Contract shall prevail.-----

2.7 Construction Manager - shall mean the professional assigned by the Contractor to provide the construction management services on the project. This professional shall be a professional engineer registered in Puerto Rico and an active member of the Puerto Rico College of Engineers and Land Surveyors.-----

2.8 Change Order - A written agreement between the parties that sets out changes in price, time, or Scope of Contract.-----

2.9 Critical Path Method (CPM) – A scheduling technique used to plan and control a project that combines all relevant information into a single plan defining the sequence and duration of operations, and depict the interrelationship of the work elements to complete the project. The critical path is define as the longest sequence of activities in a network, which establishes the minimum length of the time for accomplishment, the last event of the project.-----

2.10 Delay - Event that extends (affect) the completion date of the project, by affecting tasks on the critical path. The project schedule shall clearly display that the Contractor has used, in full, all the float time available for the work involve with this request. -----

2.11 Disruption - The effect of events upon a non-critical path that, while using additional recourses and extending the duration of that particular activity, or path of activities, does not extend the end date of the project.-----

2.12 Engineer - shall mean the PREPA's Director of Generation, acting directly or through his properly authorized representatives. -----

2.13 Final Acceptance – shall mean the written approval by PREPA that Services are completed, the final cleaning up of the site has performed, and all Punch List items have rectified.-----

2.14 Force Account Work - Extra work in which the Contractor delegate the administration to PREPA and that is paid for on the basis of actual costs for labor, materials, equipment, bonds, insurance, and taxes, plus an established allowance, as provided in this Contract or Special Conditions.-----

2.15 Letter of Award (LOA) – Letter signed by the Director of the Generation, to notify the bidder that the bid is being awarded to him and to require documents prior to contract signing, such as but not limited to; Corporate Resolution, evidence of payment and certificate of the Puerto Rico State Insurance Fund, municipal taxes, Construction excise taxes, certificate of insurances and endorsements, payment and performance bonds. The Contractor shall, not later than ten (10) working days, after receipt of the Letter of Award (LOA), furnish all documents required therein. -----

2.16 Letter of Release – Letter signed by the Contractor's contracting officer and notarized stating that the Contractor has no debt with, but no limited to, subcontractors, consultants, material and services supplier, Federal and State Agencies, Municipality, manufacturer or insurance agency. -----

2.17 Notice to Proceed – a written order sent to the Contractor by the Contracting Officer, or his designated representative, notifying the Contractor of the date upon which the Contractor is given authority to begin the work. -----

2.18 Owner – designates the Puerto Rico Electric Power Authority (PREPA). -----

2.19 Punch List - shall mean the list of non-conforming or incomplete work items identified by PREPA for the Final Acceptance of Services.-----

2.20 Resident Engineer - shall mean the manager of the field office responsible for, but not limited to, the administrative issues, quality control, and technical aspects of the project. This person shall be a professional engineer register in Puerto Rico and an active member of the Puerto Rico College of Engineers and Land Surveyors. The Resident Engineer shall always be present on site in order to the Contractor be able to perform any task of the project. -----

2.21 Safety Officer – shall be the person designated by the Contractor whose duty shall be the prevention of accidents and implement, both, the Safety and Health Program and the Site Specific Work Plan. The Safety Officer may be the Contractor's project superintendent or supervisor and shall comply with occupational safety and health requirements for the construction industry. The Safety Officer shall be present at all times on site in order to the Contractor be able to perform any task of the project.-----

2.22 Special Conditions – are all special requirements, regulations and/or directions covering conditions peculiar to a particular project.-----

2.23 Substantial Completion - shall mean the date certified by PREPA, that the Contractor shall reached the stage of completion when PREPA accepts the legal and safe use of the facility or system for its intended purposes, even though all work is not completed. At the stage, the time of completion of the entire work shall cease and the accruing of penalties. -----

However, the Contractor shall finish all items included in the Punch List before Final Acceptance of Services, including the following:-----

- A. The Service Tank S-10 is back online and with 100% availability.
- B. All coating systems (internal and external) have been installed, tested and fully cured in compliance with the specifications.-----
- C. All tank level indication equipment have been installed, tested and in service as per the specifications
- D. Contractor had submitted all certifications of compliance of field and laboratory tests.-----
- E. Contractor had submitted all debris and excess soil disposal manifests.-----
- F. All required equipment had installed and tested by Contractor.-----
- G. Site is clean.-----

2.24 Subcontractor – shall mean any supplier, or vendor of the Contractor engaged for the purposes of progressing the work under a subcontract with the Contractor and in which the Contractor has no equity interest or profit-sharing affiliation. Any such entity in which the Contractor owns equity or has a profit-sharing affiliation shall be considered to be the Contractor. Contractor shall comply with requirements set forth on ARTICLE 26 – Subcontractors. -----

2.25 Working Day – shall mean each day Monday thru Friday and hours from 7:00 AM to 11:30 AM and from 12:30 PM to 4:00 PM. -----

ARTICLE 3. Consideration

The total amount to be paid under this Contract shall not exceed [INSERT AMOUNT] (\$_____) (the Contract Amount). However, nothing herein shall preclude the Parties from agreeing to increase the Contract Amount by written amendment signed by both Parties. -----

The Contractor shall submit its invoices for work already done according to the payment schedule approved by the Engineer together with the technical supporting documents of required tests. All invoices shall be subject to the Engineer's approval before paid and shall include the actualized progress schedule, S-curve graph and all other documents

required in the Special Conditions. All invoices shall be subject to PREPA's approval before being paid, and its payment shall be done within sixty (60) days after the date of its approval. PREPA shall retain ten percent (10%) of each payment until completion and acceptance of all Services. -----

After Final Acceptance, PREPA will pay to Contractor all retained percentages less the corresponding deductions. The Contractor shall submit a Letter of Release ("Carta de Relevó"), WHICH SHALL BE NOTARIZED and in which the Contractor shall state that there is not debt with any sub-contractor, manufacturer, employee, government agency, municipality and service or materials provider. -----

Invoices must also include a written and signed certification stating that no officer or employee of PREPA, and their respective subsidiaries or affiliates, will personally derive or obtain any benefit or profit of any kind from this Contract, with the acknowledgment that invoices that do not include this certification will not be paid. This certification must read as follows:-----

We certify under penalty of absolute nullity that no public servant of PREPA is a party or has any interest in the benefit or profit product of the Contract, which is the basis of this invoice. If such benefit or profit exists, the required waiver has been obtained prior to entering into the Contract. The only consideration to be received in exchange for the delivery of Services provided is the agreed-upon price that has been negotiated with an authorized representative of PREPA. The total amount shown on this invoice is true and correct. The Services have been rendered, and no payment has been received.

Contractor's Signature

All professionals admitted to practice a profession in Puerto Rico, who will provide services through this Contract; must provide prior to the execution of the Contract evidence of said license issued by the corresponding regulatory entity. -----

ARTICLE 4. Commencement and Completion of Work

4.1 General

The Contractor shall be required to complete all task and project scope within one hundred eighty (180) calendar days from the date of the Notice to Proceed, subject to the provisions stated in Article 8, Changes and/or Extra Work, Article 13, Force Majeure; Article 17, Termination for Convenience; and Article 18 Termination for Cause. The Contractor shall receive a written order, stating the date on which the Contractor shall commence to execute the contracted work. Thus, Notice to Proceed date marks the beginning of commencement of work. Mobilization shall be completed within ten (10) days after the Notice to Proceed. Both Parties agree that time is the essence of the Contract.-----

The demand of the obligations of either party under this Contract will be subject to the filing of the Contract at the Office of the Comptroller of the Commonwealth of Puerto Rico, in compliance with Act of October 30, 1975, No. 18, as amended.-----

The Contractor shall, not later than ten (10) working days, after receipt of the Letter of Award (LOA) signed by the Engineer, furnish all documents required therein.-----

4.2 Schedule of Proposed Progress

The Contractor, within fifteen (15) days after receipt of the Notice to Proceed shall file with the Engineer a schedule of proposed progress and the proposed detailed method of carrying on the Services including a full statement of equipment and equipment layout for the job. This progress chart and statement of operations shall show the dates of commencement and completion of each item of the Services. This schedule shall also include the milestones for the submittals and material ordering, the critical path of the project, and the man-hours per item. The Contractor shall provide for the use of adequate and sufficient equipment and force and a method of operations to assure the completion of the work within allotted time. The schedule shall be monthly actualized and submitted to PREPA for approval. All requirements on the attached Special Conditions shall also apply.-----

4.3 S-curve Graph

The Contractor shall file the S-curve Graph within fifteen (15) days after receipt of the Notice to Proceed. The S-curve shall plotted with the percent of work

completed in the Y-axis and the cost in the X-axis. This graph shall be based on the proposed schedule define on Section 4.2 above.-----

4.4 Payment Schedule

The Contractor within fifteen (15) days after receipt of the Letter of Award. The Schedule of Payment shall be balanced throughout the whole project and if said schedule is not satisfactory to the Engineer, it shall be revised by the Contractor and resubmitted for its approval.-----

4.5 Contract Quantity Report

The Contractor shall submit weekly and for approval, to the Engineer, the Contract Quantity Report sheet. The Contractor at the preconstruction meeting will give the format for this sheet.-----

ARTICLE 5. Suspension of Work

The Contracting Officer may, at any time, suspend the whole or any portion of the Services under this Contract, but this right shall not be construed as denying the Contractor actual reasonable and necessary expenses due to delays, caused by such suspension. These expenses shall not be allowed when ordered by the Contracting Officer because of a Force Majeure Event, as defined in Article 13, Force Majeure. The cause of such suspension shall be put in writing by the Contracting Officer within two (2) working days after the suspension or as soon as practicable.-----

ARTICLE 6. Other Work at the Site

PREPA reserves the right to perform other work by force account and/or enter into other contracts in connection with the Services. The Contractor shall afford PREPA and other contractor reasonable opportunity for the introduction and storage of materials and the execution of the work and shall properly connect and coordinate his work with theirs. The Contractor shall inspect and promptly report to PREPA any defects in such work or any conflicts between such work and that of the Contractor.-----

ARTICLE 7. Submittals

The Engineer shall evaluate submittals within fifteen (15) working days to mark them as disapproved; approved as corrected or approved it becomes necessary. The Contractor is responsible to submit three (3) sets of the submittals. All disapproved submittals shall be corrected as required and resubmitted for PREPA's evaluation. In case of discrepancy in the submittals, including Contractor's disagreement with corrections requested by the Engineer or PREPA, the matter shall be

submitted to the Engineer, and the Contractor shall not proceed with the work so affected until the Parties resolve such discrepancy in good faith. -----

Review or approval of Contractor's submittals shall in no way relieve the Contractor from its responsibilities, obligations or liabilities under this Contract. The Contractor shall obtain such reviews or approval in writing from PREPA. The Contractor shall keep at the site one hard copy of the Contract documents, specifications and drawings, and shall give the Engineer access thereto. Anything called for in the specifications and not shown on the drawings or shown on the drawings and not mentioned in the specifications shall be of like effect as if called for or shown on both. All construction work called for in the specifications and/or shown on the drawings to be performed by the Contractor shall be performed in strict accordance with the technical requirements of the Specifications.-----

Before commencement of Services, the Contractor shall submit for PREPA's approval the Occupational Safety and Health Program required in Article 44. Safety Provisions.--

ARTICLE 8. Changes and/or Extra Work

PREPA may, at any time, make changes or order extra work within the Scope of Work subject to previous written approval of the Contracting Officer. Changes requested by PREPA may include, but not limited to, changes: -----

1. In the specifications including drawings and design.
2. In the method or manner of performance of the Services.
3. In PREPA's furnished facilities, equipment, materials, services, or site; and/or,
4. Acceleration in the performance of the Services.

Within ten (10) working days after receipt of PREPA's written order of a change in the work (or such shorter or longer period of time as may be reasonably required as agree by PREPA and the Contractor), Contractor shall promptly notify PREPA of the cost, schedule and other impact(s) Contractor anticipate as a result of the change. If PREPA agrees with the Contractor's statement as to the impact of the change, the Parties shall proceed promptly to enter into a written change order in connection with such change to equitably adjust Contractor's cost (increase or decrease), schedule (lengthen or shorten), or other obligations under Contract in connection with such change. PREPA shall promptly notify Contractor in writing of the basis for any disagreement and PREPA and Contractor shall negotiate in good faith to resolve any issues in order to, when applicable, enter into a written change order to equitably adjust Contractor's cost (increase or decrease), schedule (lengthen or shorten), or other obligations under the Contract in connection with such change. Acceptance of the change order and an adjustment in the Contract Amount and/or Contract time shall not be unreasonable withheld. -----

If agreement on the prices for the extra work cannot be reached between PREPA and the Contractor, PREPA may order in writing the Contractor to perform the required work on a force account basis. Payment for such Force Account work shall be as specified in Article 1.10 - Force Account, of the Special Conditions. PREPA may also elect to have such work performed by its own forces or by separate contract. -----

In order to facilitate review of quotations for extras or credits, all proposals submitted by Contractor in connection with a change in the work by PREPA, except those so minor that their propriety can be seen by inspections, shall be accomplished by a complete itemization of the costs including labor, materials, equipment and subcontracts. When subcontractors perform major cost items, they shall itemized it. -----

ARTICLE 9. Inspection

9.1.1 Periodic Inspection

All material and workmanship (if not otherwise designated by the specifications) shall be subject to inspection, examination, and test by PREPA's inspectors, at all reasonable times. PREPA shall have the right to reject defective material, equipment or workmanship or require its correction. Rejected workmanship shall be satisfactorily corrected and rejected material and equipment furnished by the Contractor shall be satisfactorily replaced with proper material and equipment, without charge to PREPA. The Contractor shall promptly remove rejected material from the premises. The Contractor shall furnish promptly all reasonable facilities, labor, materials, and equipment necessary for the safe and convenient inspection and tests that may be performed in such manners as not to unnecessarily delay the work.-----

9.1.2 Final Inspection

Whenever all the materials have been furnished and all work has been performed, including final cleaning up as contemplated in ARTICLE 45. Cleaning Up, all in accordance with the drawings and specifications, the Contractor shall notify in writing the Engineer that said work is completed and ready for final inspection. Final inspection shall occur within a ten (10) working days period after the Engineer has received notice from the Contractor of the satisfactory completion of the installation of the equipment.----

After receipt of notice, PREPA will notify Contractor of the exact date and time of the final inspection and Contractor shall accommodate PREPA's specific time. If all installation work provided for and contemplated by the Contract is found completed in accordance with the specifications, this inspection shall constitute the final inspection and the Completion Date shall be established as the date of receipt of the notice of the Contractor that the work was completed and ready for final inspection. If, however,

upon inspection by the Engineer it is found that any work, in whole or in part, is unsatisfactory, the Engineer shall give the Contractor the necessary instructions as to replacement of material and performance of work necessary to final completion and acceptance and the Contractor shall immediately comply with and execute such instructions. Upon satisfactory replacement and performance of such work, the Contractor shall notify the Engineer, and another inspection shall be made which will constitute the final inspection if the said material is found to have been acceptably replaced and the work completed satisfactorily. In such event, the date of receipt of this last notice of the Contractor will be established as the Completion Date of the work or any separable part thereof under the Contract. The Completion Date, thus established, shall be used in calculating the actual time of performance of the work. -----

The determination of whether a project is substantially completed is at the discretion of PREPA. This project shall be considered substantially completed as established in the Article 2.23, Substantial Completion, when PREPA accepts the legal and safe use of the facility or system for its intended purposes, even though not all work is completed. At the stage, the time of completion of the entire work shall cease and the accruing of penalties. However, the Contractor shall finish all items included in the Punch List before Final Acceptance of Services, including items listed in Article 2.23, Substantial Completion.-----

ARTICLE 10. Superintendence by the Contractor

Before commencement of the work, the Contractor shall designate a competent construction manager, satisfactory to the Engineer, with the expertise and resources necessary to provide construction management services. The Contractor shall also designate a competent resident engineer, satisfactory to the Engineer, on the work site, at all times, during progress of the work, with authority to act for him. The construction manager and resident engineer shall represent the Contractor on his absence and all directions given to him by the Engineer shall be as binding as if given to the Contractor. The Contractor shall, at all times, enforce strict discipline and good order among his employees and shall not employ on the work any unsuitable or unskilled person in the work assigned to him. In addition, the Contractor shall be fully responsible for the negligent or wrongful acts or omissions of subcontractors or of persons both directly or indirectly employed by the Contractor, and shall be liable to PREPA and/or any affected third parties for such acts or omissions. -----

ARTICLE 11. Sanitary Facilities

The Contractor shall furnish and maintain satisfactory, sanitary facilities for the use of the workers engaged in the construction, as required by law or regulations. -----

ARTICLE 12. Access to Work

The Contractor shall permit all persons appointed or authorized by PREPA to visit and inspect the work, or any part thereof at all times, and places during the progress of it. ---

ARTICLE 13. Force Majeure

The Parties hereto shall be excused from performing hereunder and shall not be liable in damages or otherwise, if and only to the extent that they shall be unable to perform or are prevented from performing by a force majeure event. For purposes of this Contract, force majeure means any cause without the fault or negligence, and beyond the reasonable control of, the party claiming the occurrence of a force majeure event. Force majeure may include, but not be limited to, the following: Acts of God, industrial disturbances, acts of the public, enemy, war, blockages, boycotts, riots, insurrections, epidemics, earthquakes, storms, floods, civil disturbances, lockouts, fires, explosions, interruptions of services due to the acts or failure to act of any governmental authority, provided that these events, or any other claimed as a force majeure event, and/or its effects, are beyond the reasonable control and without the fault or negligence of the party claiming the force majeure, and that such party, within ten (10) days after the occurrence of the alleged force majeure, gives the other party written notice describing the particulars of the occurrence and its estimated duration. The burden of proof as to whether a force majeure has occurred shall be on the party claiming the force majeure.

ARTICLE 14. Penalty for Delays

If the Contractor fails to complete the work, or any separable part thereof, within the time established in the Article 4, Commencement and Completion of Work, the Contractor shall pay to PREPA a penalty of one thousand five hundred dollars (\$1,500) for each calendar day of delay in completing the Services, up to a maximum of fifteen percent (15%) of the Contract Amount, and the Contractor and his sureties shall be joint and several liable for said amount. In the event that the Contractor, due to his delay, had pay the total amount of the penalty, and has failed to complete the Services or any part separable thereof, it could be considered a breach of the Contract, and PREPA may terminate the Contract, execute the performance bond and pursue any other remedies under this Contract, law or equity.-----

In case of delay, the Contractor shall within ten (10) days from the beginning of any such delay notify the Head, Engineering and Technical Services Division in writing of

the causes of delay, who shall ascertain the facts and the extent of the delay and extend the time for completing the Services when, in his judgment, the findings of facts justify such an extension, and his findings of facts thereon shall be final and conclusive on the parties hereto, subject only to appeal by the Contractor as provided in Article 30, Disputes, hereof; provided that, no claim shall be made by the Contractor against PREPA, its agents, contractors, subcontractors, employees, successors, assignees, for any cause whatsoever, during the progress of any portion of the Services embraced in the Contract. Any damages caused by delays or hindrances exclusively by PREPA shall be considered as fully compensated for by the extensions of time as provided above.-----

If PREPA does not terminate the right of the Contractor to proceed, the Contractor shall continue the Services in which event shall pay to PREPA a penalty in the amount set forth above for each calendar day of delay until the Services are completed, and the Contractor and his sureties shall be liable for the amount thereof; provided that, the right of the Contractor to proceed shall not be terminated or the Contractor charged with a penalty because of any delays in the completion of the Services due to force majeure events or situations, or failures on the part of PREPA to carry out its obligations.-----

PREPA shall have the right to the payment or to the withholding of Contractor's payments in case of Contractor's delay in completion of the Services. The Contractor agrees that the penalty shall not be subject to reduction, moderation or modification, since this penalty is a pecuniary punishment for the delay, and not a liquidation of damages.-----

ARTICLE 15. Liabilities

15.1 Civil Responsibility

The appearing parties agree that the Puerto Rico Civil Code and its case law, as dictated by the Supreme Court of Puerto Rico will govern their responsibilities for damages under this Contract.-----

15.2 Protection Against the Occurrence of Damages

The Contractor agrees to make, use, provide, and take all proper, reasonably necessary and sufficient precautions, safeguards, and protection against the occurrence or happenings of injuries, death and/or damages to any person or property during the progress of the work.-----

15.3 Save and Harmless

The Contractor agrees to indemnify and save harmless PREPA for all expenses and costs of any nature (including attorneys' fees) incurred by PREPA arising out

of any claim made by any person for personal injuries, including death, sustained by any person, including the employees of Contractor, and for damage to third party property to the extent such injuries, death or third party damages are caused by the fault, negligent acts or omission of Contractor, its employees, subcontractors or affiliated companies, arising out of its or their performance and/or failure to perform the Services. -----

15.4 Save Harmless for Operation of PREPA's Equipment

The operation of PREPA's equipment by PREPA at its plant site is within the exclusive control of PREPA. PREPA shall indemnify and save harmless the Contractor from loss, expense or liability imposed upon the Contractor for any injury to a person, including death resulting therefrom or damage to any property resulting from the operation of such equipment by PREPA.-----

If the Contractor is allowed to operate PREPA's equipment at the plant site, the Contractor shall indemnify and save harmless PREPA from loss, expense or liability imposed upon PREPA for any injury to a person, including death resulting there from or damage to any property resulting from the operation of such equipment by the Contractor.-----

15.5 Contractor's Liability

The overall aggregate liability of Contractor with respect to any and all claims arising out of the performance or non-performance of obligations under the Contract, regardless of any legal theory or cause of action under which such liability may arise, shall not exceed the Contract Price (which includes authorized changes, if any). However, the foregoing dollar limitation shall not apply to liability arising from third party claims for bodily injury or third party property damage to the extent such liability results from Contractor's fault or negligent acts or omissions while working under the Contract. -----

ARTICLE 16. Independent Contractor

The Contractor shall be considered as an independent contractor, for all material purposes under this Contract, and all persons engaged or contracted by the Contractor for the performance of its obligations herein, shall be considered as its employees or agents or those of its subcontractors, and not as employees or agents of PREPA.

In consequence, the Contractor is not entitled to any fringe benefits, such as, but not limited to vacations, sick leave, and other.-----

ARTICLE 17. Termination for Convenience

PREPA shall have the right to terminate this Contract for convenience, at any moment, by providing the other party thirty (30) days written notice by registered mail, return receipt requested, or overnight express mail. If notice is given, this Contract shall terminate upon the expiration of thirty (30) days and PREPA shall be obligated to pay all fees and expenses incurred up to the day of effective termination, in accordance with the terms of this Contract. The rights, duties and responsibilities of the Parties shall continue in full force and effect during the thirty (30) day notice period. Contractor shall have no further right to compensation except for what has been accrued for services rendered under this Contract until said date of effective termination.-----

ARTICLE 18. Termination for Cause

PREPA shall have the right to terminate this Contract immediately in the event of negligence, dereliction of duty, noncompliance, or material breach by the Contractor, as determined in the sole discretion of PREPA, or for any other reason described elsewhere in this Contract as a basis for termination. In the event the Contract is terminated by PREPA for cause, PREPA shall be obligated to pay all fees and expenses incurred up to the day of effective termination, in accordance with the terms of this Contract. Contractor shall have no further right to compensation except for what has been accrued for services rendered under this Contract until said date of effective termination.-----

ARTICLE 19. Insurance, Bonds, and Indemnities

The Contractor shall secure and maintain in full force and effect during the life of this Contract as provided herein, policies of insurance covering all operations engaged in by the Agreement:-----

19.1. Commonwealth of Puerto Rico Workmen's Compensation Insurance:

The Contractor shall provide Workmen's Compensation Insurance as required by the Workmen's Compensation Act 45-1935 of the Commonwealth of Puerto Rico. The Contractor shall also be responsible for compliance with said Workmen's Compensation Act by all its subcontractors, agents, and invitees, if any.

The Contractor shall furnish to PREPA a certificate from the Puerto Rico State Insurance Fund showing that all personnel employed in the work are covered by the Workmen's Compensation Insurance, in accordance with this Contract. -----

19.2 Employer's Liability Insurance

The Contractor shall provide Employer's Liability Insurance with minimum bodily injury limits of \$1,000,000 for each employee and \$1,000,000 for each accident, covering against the liability imposed by Law upon the contractor as a result of bodily injury, by accident or disease, including death arising out of and in the course of employment, outside of and in the course of employment, and outside of and distinct from any claim under the Workmen's Compensation Act of the Commonwealth of Puerto Rico.-----

19.3 Commercial General Liability Insurance

The Contractor shall provide a Commercial General Liability Insurance with limits of \$1,000,000 per occurrence and \$1,000,000 aggregate. This Policy shall include a completed operations and products coverage.

19.4 Commercial Automobile Liability Insurance

The Contractor shall provide an Automobile Liability Insurance with limits of \$1,000,000 combined single limit covering all owned, non-owned and hired automobiles.-----

19.5 Professional Liability Insurance

The Contractor shall provide a Professional Liability Insurance with limits of \$1,000,000 per claim and \$1,000,000 per aggregate.-----

Requirements Under the Policies:

The Commercial General Liability and Automobile Liability Insurance required under this Contract, shall be endorsed to include:

A. As additional insured:

Puerto Rico Electric Power Authority
Risk Management Office
PO Box 364267
San Juan, PR 00936-4267

B. A 30 days cancellation or nonrenewable notice to be sent to the above address.

- C. An endorsement including this Contract under contractual liability coverage and identifying it by number, date and parties to the Contract.
- D. Waiver of Subrogation in favor of PREPA.
- E. Breach of Warranties or Conditions:

“The Breach of any Warranties or Conditions in these policies by the Contractor shall not prejudice PREPA’S rights under this policy.”

Bonds

As a Contract security, the Contractor shall furnish at any time before the execution of the Contract:-----

A Performance Bond in the amount of one hundred percent (100%) of the contract price, with good and sufficient surety satisfactory to the Authority guaranteeing that the contractor will well and faithfully perform the contract work.-----

A Payment Bond in the amount of one hundred percent (100%) of the contract price, with good and sufficient surety satisfactory to the Authority to guarantee the prompt payment of all labor, supervision, equipment and materials required in the performance of the work.-----

All bonds shall be issued in the official form of PREPA.-----

Furnishing of Policies:

All required policies of insurance shall be in a form acceptable to the Authority and shall be issued only by insurance companies authorized to do business in Puerto Rico.-----

The Contractor shall furnish a certificate of insurance in original signed by an authorized representative of the insurer in Puerto Rico, describing the coverage afforded.-----

ARTICLE 20. Permits and Licenses

The Contractor shall obtain, maintain and submit evidence of all the licenses, permits and authorizations required to perform all Services and tasks under this Contract, and shall send all notices, pay all fees, and related costs and will comply and will have its subcontractors if any, and agents comply with all laws, ordinances, rules, and regulations applicable to the Services. -----

ARTICLE 21. Other Contracts

PREPA may award other contracts for additional work, and the Contractor shall fully cooperate with such other contractors, in accordance with ARTICLE 6. Other Work at the Site, of this Contract, and carefully fit his own work to that provided under other contracts as may be directed by the Contracting Officer. The Contractor shall not commit or permit any acts, which interfere with the performance of work by any other contractor. -----

ARTICLE 22. Claims for Labor and Materials

The Contractor shall, at his own expense, assume the defense of and save harmless PREPA from claims arising out of and in connection with Contractor furnished labor and materials, and PREPA shall not suffer any mechanics or other liens to remain outstanding against any property used in connection with the Services; and shall, on request, furnish satisfactory evidence that all persons who have done work or furnished materials have been fully paid. If the Contractor fails to comply with his obligations in this respect, PREPA may take such liens or claims and may withhold from any monies due to the Contractor such amounts as may be necessary to satisfy and discharge any such claims and any cost and expense incidental thereto.-----

ARTICLE 23. Minimum Wage Rates

The Contractor and all subcontractors shall comply with the requirements prescribed by the federal Davis-Bacon Act (Public Law 107-217- August 21, 2002 as amended, 40 USC §3141 et seq.). As therein required, contractors and subcontractors performing on contracts funded directly by or assisted in whole or in part with American Recovery and Reinvestment Act appropriations in excess of \$2,000 shall pay all laborers and mechanics not less than the locally prevailing wage rates and fringe benefits, as determined by the Secretary of Labor, for corresponding classes of laborers and mechanics employed on similar projects in the area.-----

ARTICLE 24. Unfair Labor Practice

In the event that the Contractor or any of his subcontractors or agents do not comply with an order issued by the Puerto Rico Labor Relations Board and/or the National Labor Relations Board upon their finding that the Contractor or any of his subcontractors or agents have committed an unfair labor practice, no further payments shall be made by PREPA to the Contractor after the date of the said order. In addition, the Contract may be terminated by PREPA, in which case PREPA may take possession of the materials, tools, and appliances on the job site and finish the work by whatever method it may deem expedient. Any declaration by the Puerto Rico Labor Relations Board and/or by the National Labor Relation Board that the contractors or agents have

not complied with an order issued by the Board relating to any unfair labor practice, shall be binding, final, and conclusive unless such order is reversed or set aside by a Court of competent jurisdiction.-----

ARTICLE 25. Assignment

This Contract or any interest therein or any monies due or to become due there under shall not be assigned, mortgaged or otherwise disposed of without the previous consent in writing of the Contracting Officer. -----

ARTICLE 26. Subcontractors

The Contractor shall not subcontract its rights and obligations under this Contract, except in the event PREPA gives written authorization for such actions. Provided that no subcontract shall be considered for PREPA's approval, except when the following requirements are met: (1) the Contractor delivers PREPA a complete, non-marked copy of the signed subcontract, not less than thirty (30) days prior to the effective date of the proposed subcontract; (2) the subcontract includes, as a condition for its legal validity and enforceability, a provision whereby PREPA has the right to substitute, subrogate or assume Contractors' rights under the subcontract, in the event that PREPA declares the Contractor in breach or default of any of the Contract terms and conditions; and (3) the subcontract includes, as a condition for its validity and enforceability, a provision establishing for the subcontractor the obligation to comply unconditionally and entirely with all Contractors' obligations under the Contract (*mirror image rule*), except for such obligations, terms and conditions which exclusively related with works or services not included under the subcontract.-----

ARTICLE 27. Novation

Contractor and PREPA agree that no amendment, during its term, it's understood as a contractual novation, unless both Parties agree to the contrary, specifically in writing. The previous provision shall be equally applicable in such other cases where PREPA gives the Contractor a time extension for the compliance of any of its obligations under the Contract or where PREPA dispenses the claim or demand of any of its credits or rights under this Contract. -----

ARTICLE 28. Patents and Copyrights

The Contractor, at its own expense, shall defend any suit or action brought against PREPA based on a claim that any equipment or part thereof, copyright or un-copyrighted composition, secret process, patented or unpatented invention, article, or appliance manufactured or used in the performance of this Contract, including their use by PREPA, constitutes an infringement of any patents or copyrights of the

United States, if notified promptly in writing by PREPA, and given the authority, information, and assistance for the defense of the same, and the Contractor shall pay all damages and costs awarded therein against PREPA. If in such suit the equipment or any part thereof, or the composition, secret process, invention, article or appliance, is held to constitute infringement and its use is enjoined, the Contractor, at its option and expense, shall either procure for PREPA the right to continue using the same or replace it with non-infringing equipment, composition, secret process, invention, article or appliance, or modify it so it becomes non-infringing; or remove it and refund the purchase price.-----

ARTICLE 29. Waivers

No waiver of any breach of this Contract shall be held to be a waiver of any other subsequent breach. All remedies afforded by PREPA in this Contract shall be taken and construed as cumulative, that is, in addition to every other remedy provided herein or by law.-----

ARTICLE 30. Disputes

Except as otherwise specifically provided in this Contract, all disputes concerning questions of fact arising under this Contract shall be decided by the Head, Engineering and Technical Services Division, subject to written appeal by the Contractor within thirty (30) days to the Contracting Officer. As soon as practicable thereafter, the Contracting Officer shall inform each party hereto of his decision regarding the dispute, which decision shall be final and conclusive upon the parties hereto, unless such decision is challenged, with in sixty (60) days, on the basis of being arbitrary, malicious or capricious. If such challenge is made, either party may pursue its remedy at law or equity. In the meantime, the Contractor shall diligently proceed with the work as directed. -----

If no written appeal to the decision by the Contracting Officer is made by the Contractor within the above established timeframe, the Contracting Officer's decision on the dispute shall be deemed final and conclusive and no further remedy shall be pursued by the Contractor. -----

ARTICLE 31. Correction of Work After Final Payment

Neither the final certificate for payment nor any provision in the Contract documents shall relieve the Contractor of responsibility for faulty materials or workmanship and, unless otherwise specified, he shall remedy any defects due thereto and pay for any damage to other work resulting therefore, which shall appear within a period of one (1) year after final acceptance. PREPA shall give notice of observed defects with reasonable promptness. All questions arising under this Article shall be decided by the

Engineer, subject to appeal by the Contractor, as provided in ARTICLE 30, Disputes, of this Contract.-----

ARTICLE 32. Laws to be Observed

Contractor shall observe and comply with any and all federal, insular and municipal laws, ordinances and regulations that in any manner affect the Services, and shall observe all such orders and decrees as exist at present or may be enacted prior to the completion of the Services by agencies or courts having any jurisdiction or authority. Contractor shall save harmless and indemnify PREPA and its representatives, officers, agents and servants for fines and penalties paid by PREPA, including attorney's fees, to governmental authorities as sole result of Contractor's violation of any such law, ordinance, regulation, order or decree, whether by Contractor or its employees, subject to limits of liability in Article 15. Liabilities. -----

ARTICLE 33. Change of Law

During the term of this Contract, any change in law, including, but not limited to changes in applicable tax law, which causes an increase in Contractor's costs when supplying the products or services to be acquired by PREPA, shall be of Contractor's responsibility and PREPA shall not be obliged to make additional payments nor to pay additional sums to the Contract Amount for those products or services. -----

ARTICLE 34. Choice of Law

During the term of this Contract, any change in law, including, but not limited to changes in applicable tax law, which causes an increase in Contractor's costs when supplying the products or services to be acquired by PREPA, shall be of Contractor's responsibility. PREPA shall not be obliged to make additional payments nor to pay additional sums to the Contract Amount for those products or services.-----

ARTICLE 35. Separability

If a court of competent jurisdiction declares any of the Contract provisions as null or invalid, such holding will not affect the validity and effectiveness of the remaining provisions of the Contract and the Parties agree to comply with their respective obligations under such provisions not included by the judicial declaration.-----

ARTICLE 36. Warranty

The Contractor warrants that all materials, parts, equipment and work performed under this Contract comply in all respect with its terms and conditions; that they are free from defects in materials and workmanship; that they are suitable and adequate for the

purposes for which they were designed and for such other purposes, and that the Services provided under this Contract will conform with the highest standards of care and practice appropriate to their nature. The warranty period will begin the date on which PREPA accepts the Services and will continue for a period of one (1) year. The Contractor will, upon written notice by PREPA, fully remedy, free of expense to PREPA, any defects as may develop on Services. The Performance Bond shall cover and serve as guarantee for this warranty.-----

For those materials, parts, equipment, which prove defective or deficient during the warranty period, the Contractor shall, at his own expense, repair or replace, transport-in, from Contractor's facilities to PREPA's site, and transport-out, from PREPA's site to Contractor's facilities, such materials, parts, and/or equipment. The Performance Bond shall cover and serve as guarantee for the Contractor's failure, completely or in part, to properly perform his obligations under this Contract.

ARTICLE 37. Notice

Any required notice to be given hereunder shall be in writing and will be sufficiently served when delivered in person or properly mailed to the following addresses:

To PREPA: Puerto Rico Electric Power Authority
PO Box 364267
San Juan, Puerto Rico 00936-4267

Attention: Carlos Negrón Alfonso
Administrator on Generation

To Contractor: [Contractor's Name]
[Mailing Address]

Attention: [Contractor's representative]

ARTICLE 38. Income Tax Withholding

PREPA will deduct and withhold at source to the Contractor the equivalent of seven percent (7%) from payment for services rendered under this Contract, in compliance with the Internal Revenue Code for a New Puerto Rico, Act No. 1-2011, as amended, section 1062.03. Notwithstanding, the withholding to be done by PREPA as herein stated could be increased to twenty percent (20%) in the event that the Contractor is a non resident individual, which is a U.S. citizen, as provided by the Act No. 1-2011, section 1062.08; or twenty-nine percent (29%) in the event that the Contractor is a non resident and non U.S. citizen individual; or a foreign corporation or partnership which is

not dedicated to industry or business in Puerto Rico, as provided by Act No. 1-2011, section 1062.08.-----

If a Release Letter is issue to the Contractor by the Treasury Department, the Contractor shall be responsible to submit a copy of said Release Letter to PREPA for every calendar year; otherwise, payments under the Contract shall remain subject to withholding at source.-----

All invoices shall be segregated by concepts (services, materials, equipment, etc.), to identify the amounts subject to withholding and avoid undue deductions.-----

ARTICLE 39. Discrimination

The Contractor certifies that he is an employer with equal opportunity employment, and do not discriminate by race reason, color, gender, age, national or social origin, social status, political ideas or affiliation, religion; for being or perceived to be a victim of domestic violence, sexual aggression or harassment, regardless of marital status, sexual orientation, gender identity or immigration status; for physical or mental disability, for veteran status or genetic information. -----

ARTICLE 40. Other Taxes

All unemployment, retirement, and other Social Security contributions and taxes; all sales, use and excise, privilege, business and occupational taxes, and any other taxes or fees payable by the Contractor are and shall be included as part of his prices.-----

ARTICLE 41. Cleaning Up

The Contractor shall remove from PREPA's property and from all public and private property all temporary structures no longer required, rubbish, and waste materials resulting from his operations.-----

Upon completion of Services, the Contractor shall remove all remaining rubbish, unused materials and other like material, belonging to him or used under his direction during the installation of the equipment. In the event of his failure to do so, PREPA may remove the same at the Contract's expense, and his surety or sureties shall be liable therefore.

ARTICLE 42. Use of Completed Portions

PREPA shall have the right to take possession of and use any completed or partially completed portions of the work, notwithstanding the fact that the time for completion of the entire work may not have expired, but such taking possession and use shall not be

deemed an acceptance of the work so taken or used or any part thereof. PREPA may require the Contractor to expedite the completion of any part of the work for provisional use by PREPA and the Contractor shall comply with such request. If such order of completion or prior use increases the cost of the work or delays the work, the Contractor shall be entitled to such extra compensation or extension of time as agreed by the Parties.-----

ARTICLE 43. Quality Assurance

The Contractor shall submit for evaluation and approval by PREPA a quality control program and establish a quality assurance program, also evaluated and approved by PREPA, to satisfy all applicable regulation and requirements specified in the procurement documents and satisfactory to PREPA. The program shall contain all those measures necessary to assure that all basic technical requisites ask for in the drawings, codes, tests, and inspections for design, fabrication, cleaning, installation, packing, handling, shipping, long term storage, when necessary, and test equipment are fulfilled. PREPA reserves the right to conduct audits and inspections to the facilities, activities, and/or documents when estimated and without previous notification necessary in order to assure that the quality control program is adequate and properly implemented. -----

The Contractor shall allow PREPA access to its facilities and documents, so that PREPA, through audits and inspections can verify the quality of the labor, equipment, products, services, and any other related items provided by the Contractor. In every case in which the materials or services furnished to PREPA are subcontracted partially or totally, by the Contractor, the Contractor shall request the subcontractor to accept and comply with all the requirements of this Article. -----

ARTICLE 44. Safety Provisions

44.1 The Contractor shall have an Occupational Safety and Health Program. A copy of this Program will be delivered to the Occupational Safety Department. The Program shall comply with the following minimum requirements of a health and safety program:-----

- a. It shall comply with all requirements from all applicable regulations included in the 29 CFR 1900.1. The Program shall have been updated within the past year from the delivery date to PREPA.-----
- b. It shall establish the mechanisms used to update and audit compliance with itself.-----

- c. It shall include an accident or incident investigation procedure. This procedure will always include the preparation of a report, which will be submitted to the Occupational Safety Department of PREPA.-----
- 44.2 The Contractor shall submit, for evaluation by the Occupational Safety Department, a copy of a Site Specific Work Plan. This plan shall include, but not be limited to, the following aspects:-----
- a. Objectives of the Work Plan-----
 - b. Description of the activities -----
 - c. Occupational safety and health considerations to be addressed before commencement of the project.-----
 - d. Procedures for achieving compliance with the applicable regulations, including, but not limited to:-----
 - i. Occupational Exposure to Lead (29 CFR 1926.62)
 - ii. Scaffolds (29 CFR 1926 Subpart L)
 - iii. Confined Spaces (29 CFR 1910.146)
 - iv. Occupational Exposure to Noise (29 CFR 1910.95)
 - v. Hazardous Materials (29 CFR 1910 Subpart H)
 - vi. Personal Protective Equipment (29 CFR Subpart I)
 - vii. Hazard Communication (29 CFR 1910.1200)
 - viii. HAZWOPER (29 CFR 1910.120)
 - ix. Fire Protection (29 CFR 1910 Subpart L)
 - x. Commercial Diving (29 CFR 1910 Subpart T)
 - xi. Respiratory Protection (29 CFR 1910.134)
 - xii. Fall Protection (29 CFR 1926 Subpart M)
 - xiii. Electrical (29 CFR 1926 Subpart K)
 - xiv. Welding (29 CFR 1926 Subpart J)
 - xv. Excavations (29 CFR 1926 Subpart P)
 - xvi. Demolitions (29 CFR 1926 Subpart T)
 - xvii. Blasting & Explosives (29 CFR 1926 Subpart U)
 - xviii. Ventilation (29 CFR 1926.57)
 - xix. Tools, Hand, and Powered (1926 Subpart I)
 - xx. Electric Industry (29 CFR 1910.269)
 - xxi. Lockout/Tagout (29 CFR 1910.147)
 - xxii. Asbestos (29 CFR 1910.1001)
 - e. It will also include any other regulation or guidelines related to safety and health that could be applicable to the scope of work, and contingency procedures that include how to proceed in an emergency situation, such as fire or chemical spill, among others. -----

- f. A list of all specialized personnel needed. Also, include copy of all training certificates, licenses or certifications required, according to the scope of work. For example: pesticide applicator, electrician, spill responder, refrigeration technician, DOT training for hazardous substances, etc. All these certificates and licenses shall be up to date. -----
 - g. Copy of the Material Safety Data Sheets (MSDS) of all chemical products to be used during the project, for evaluation and approval by PREPA's Occupational Safety and Health Office (Hazard Communication Section).
 - h. Certification of compliance with medical surveillance requirements, according to scope of work. -----
 - i. Certification of compliance with Fit Test requirements for the use of respirators that make a face seal. -----
 - j. Safety equipment and materials to be used during the project.-----
 - k. Procedures to verify the work area after each work day and at the end of the project. -----
 - l. Each Contractor/Subcontractor shall comply with a 100% drug /alcohol free work zone. At minimum, pre-project and post accident testing is required. A positive post accident test or positive pre-project test will result in worker dismissal from the project. Testing will be performed in following closely the NIDA standards. -----
- 44.3 Before commencement of work, the Contractor shall take part in a coordination meeting with the designated Safety Officer and Construction Manager, and the project manager on PREPA's behalf. During this meeting the areas to be worked on will be toured, the site specific work plan will be discussed and reviewed, and amendments to it could be required. -----
- 44.4 If the contracted services include demolition activities (as defined per ANSI A10.6 – 1990: Demolition – the dismantling, razing or wrecking of any fixed building or structure or any part thereof) that will be carried out in buildings or structures, that because of their construction date or prior use, are suspected to contain asbestos, lead based paint or other hazardous materials, the Contractor will require a certification from the project manager or owner stating that the building or structure is free of such materials.-----
- 44.5 Services including activities inside buildings occupied by working personnel, that could create a hazard to their safety or health, will be offered AFTER PREPA'S WORKING HOURS. The Contractor will take all steps necessary to assure the area will be free of nuisance odors or vapors before is reoccupy by PREPA's personnel. All these will be done in coordination with PREPA's local supervisor.-----
- 44.6 The Contractor shall assure that all wastes are removed and properly disposed of, in accordance with all applicable laws and regulations, at the end of every work shift and after the completion of the project.-----
- 44.7 All chemical products to be used shall be classified as Approved or Conditionally Approved by PREPA's Hazard Communication Section.-----

- 44.8 Welding operations will comply with the requirements of OSHA, ANSI and NFPA.-----
- 44.9 If the project involves the handling of non-asbestos insulation or other dust generating materials, like gypsum board, steps shall be taken to prevent the release of the dust to adjacent areas
- 49.10 The Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to all employees on the work and all other persons who may be affected. Also, to the work, property, material and equipment on or off the site, under the care, custody or control of the Contractor or any of his subcontractors.-----
- 44.11 The Contractor shall comply with all applicable laws, ordinances, rules, regulations and lawful orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. He shall erect and maintain, as required by existing conditions and progress of the work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.-----
- 44.12 The Contractor shall designate a responsible Safety Officer of his organization, evaluated and approved by PREPA, who shall be at all times at the project site, whose only duty shall be the prevention of accidents, implement both the Safety and Health Program and the Site Specific Work Plan in coordination with the Safety Officer from PREPA. The Contractor's Safety Officer shall have successfully completed the thirty (30) hours Occupational Safety and Health Administration course in occupational safety and health standards for the construction industry. Contractor shall also have on site available at any time the latest revision of the OSHA Standards for the Construction Industry Manual.
- 44.13 Compliance with all safety provisions by subcontractors shall be the responsibility of the Contractor.-----
- 44.14 Contractor agrees that it shall perform all work in compliance with federal, state and local occupational safety and health regulations, as described in the Site Specific Work Plan.-----
- 44.15 Contractor will obtain and maintain, during the duration of the Contract, the proper permits from all federal, state and local regulatory authorities or other applicable government agency with respect to discharge, disposal, use, storage, handling and transportation of hazardous chemicals and substances as and when applicable law or regulation requires. For projects including the handling of asbestos, lead, or spilled hazardous substances, the notification to EPA or the EQB will be done by the Contractor, but in coordination with the Safety Officer and the Environmental Advisor or Officer.-----
- 44.16 Contractor will not cause or permit any hazardous chemical or product containing a hazardous chemical to be at, or in the vicinity of, any place where any employee, agent, or contractor of PREPA, or any employee of any such

- agent or Contractor, may be at risk or exposed to hazard as a result thereof during normal use or any foreseeable emergency.-----
- 43.17 Contractor will defend, indemnify and hold harmless, PREPA, its employees, agents or assignees for any and all direct liabilities and expenses arising out of contractor noncompliance with these clauses irrespective of any other terms of this Contract.-----

ARTICLE 45. Environmental Liabilities

The Contractor agrees to indemnify PREPA for all expenses and costs of any nature arising out of any claim due to an environmental violation, caused by his agents, employees, subcontractors or assigns during the performance or non-performance of its obligations under the Contract. The Contractor shall have available, and close to the working area, the necessary equipment to control and pick-up any spills that could occur during the performance of the work required by the Contract. The equipment should include all the necessary materials for the waste disposal. All equipment to be used in the work area should be free of oil, transmission fluid or hydraulic fluid leakages. If the equipment develops a leakage during the work process, it should be repaired or replaced immediately. The Contractor shall inform and coordinate with the Supervisor of the Environmental Section any work to be done to avoid any environmental violation. The Contractor shall comply with all the arrangements established in the Consent Decree between PREPA and the Environmental Protection Agency.-----

PREPA shall dispose of all waste generated because of this work, according to the Environmental regulations. The use of PREPA's waste disposal equipment by the Contractor is not permitted. -----

The Contractor, upon completion of the work, shall hand-in the assigned work area free of contaminants according to the laboratory analysis before and after the work. Before starting the work, the Contractor shall submit the work plan to PREPA for evaluation of the Environmental Protection Division. -----

All chemical analysis shall be performed by PREPA at an approved laboratory. PREPA's personnel will audit the sampling and the disposal of waste material. -----

The disposal of non-hazardous and hazardous waste material shall be done in a PREPA approved landfill. -----

The Contractor shall submit evidence of compliance with 49 CFR 72 Sub. Part H (DOT).

A company previously approved by PREPA will perform all remedial actions and environmental work. All work shall be performed according to the Best Management Practice Plan (BMPP), which is part of the Special Conditions of the NPDES Permit.-----

ARTICLE 46. Compliance with the Commonwealth of Puerto Rico Contracting Requirements

The Contractor will comply will all applicable State Law, Regulations or Executive Orders that regulate the contracting process and requirements of the Commonwealth of Puerto Rico. Particularly: -----

- A. Executive Order OE-1991-24 of June 18, 1991 to require certification of compliance with the Internal Revenue Services of the Commonwealth of Puerto Rico: Pursuant to Executive Order OE-1991-24 of June 18, 1991, the Contractor will certify and guarantee that it has filed all the necessary and required income tax returns to the Government of Puerto Rico for the last five (5) years. The Contractor, further will certify that it has complied and is current with the payment of any and all income taxes that are, or were due, to the Government of Puerto Rico. The Contractor shall provide, to the satisfaction of PREPA, and whenever requested by PREPA during the term of this Contract, the necessary documentation to support its compliance with this clause. The Contractor will be given a specific amount of time to produce said documents. During the term of this Contract, the Contractor agrees to pay and/or to remain current with any repayment plan agreed to by the Contractor with the Government of Puerto Rico. Executive Order 1991OE24.-----
- B. Executive Order OE-1992-52 of August 28, 1992 to require certification of compliance with the Department of Labor of the Commonwealth of Puerto Rico. Pursuant to Executive Order 1992-52, dated August 28, 1992 amending OE-1991-24, the Contractor will certify and warrant that it has made all payments required for unemployment benefits, workmen's compensation and social security for chauffeurs, whichever is applicable, or that in lieu thereof, has subscribed a payment plan in connection with any such unpaid items and is in full compliance with the terms thereof. The Contractor accepts and acknowledges its responsibility for requiring and obtaining a similar warranty and certification from each and every Contractor and Sub Contractor whose service the Contractor has secured in connection with the services to be rendered under this Contract and shall forward evidence to PREPA as to its compliance with this requirement. Executive Order 1992OE52.-----
- C. Social Security and Income Tax Retentions: In compliance with Executive Order 1991 OE- 24; and C.F.R. Part 404 et. Seq., the Contractor will be responsible for rendering and paying the Federal Social Security and Income Tax Contributions for any amount owed as a result of the income, from this Contract. Executive Order 1991OE24; C.F.R. Part 404 et. Seq.-----

- D. Government of Puerto Rico Municipal Tax Collection Center: The Contractor will certify and guarantee that it does not have any current debt with regards to property taxes that may be registered with the Government of Puerto Rico's Municipal Tax Collection Center (known in Spanish as *Centro de Recaudación de Ingresos Municipales* ("CRIM")). -----

The Contractor further will certify to be current with the payment of any and all property taxes that are or were due to the Government of Puerto Rico. The Contractor shall provide, to the satisfaction of PREPA and whenever requested by PREPA during the term of this Contract, Certification issued by the Municipal Revenues Collection Center (MRCC), assuring that Contractor does not owe any tax accruing to such governmental agency. To request such Certification, Contractor will use the form issued by the MRCC (called "CRIM-Certificados, Radicación, Estado de Cuenta y Todos los Conceptos" in the website). -----

- E. Puerto Rico Child Support Administration (ASUME): The Contractor shall present, to the satisfaction of PREPA, the necessary documentation certifying that the Contractor nor any of its owners, affiliates of subsidiaries, if applicable, have any debt, outstanding debt, or legal procedures to collect child support payments that may be registered with the Puerto Rico Child Support Administration (known in Spanish as the *Administración Para el Sustento de Menores* (ASUME)). The Contractor will be given a specific amount of time to deliver said documents. 3 L.P.R.A. § 8611 et seq.-----

- F. Certificate of Incorporation, or Certificate of Organization or Certificate of Authorization to Do Business in Puerto Rico issued by the Puerto Rico Department of State.-----

- G. Good Standing Certificate issued by the Puerto Rico Department of State.-----

- H. The Contractor hereby certifies that it does not represent particular interests in cases or matters that imply conflicts of interest, or of public policy, between the executive agency and the particular interests it represents.-----

- I. Articles extracted, produced, assembled, packaged or distributed in Puerto Rico by enterprises with operations in Puerto Rico, or distributed by agents established in Puerto Rico shall be used when the service is rendered, if they are available.-----

- K. If any of the previously required Certifications shows a debt, and Contractor has requested a review or adjustment of this debt, Contractor will certify that it has made such request at the time of the Contract execution. If the requested review or adjustment is denied and such determination is final, Contractor will provide, immediately, to PREPA a proof of payment of this debt; otherwise, Contractor

accepts that the owed amount be offset by PREPA and retained at the origin, deducted from the corresponding payments.-----

Contractor recognizes that submittal of the aforementioned certifications and documents is an essential condition of this Contract; and even in the case that they are partially incorrect, there will be sufficient cause for PREPA to terminate, cancel or rescind the Contract, and Contractor have to refund all payments received.-----

ARTICLE 47. Anti-Corruption Code for a New Puerto Rico.

Contractor agrees to comply with the provisions of Act 2-2018, as the same may be amended from time to time, which establishes the Anti-Corruption Code for a New Puerto Rico. The Contractor hereby certifies that it does not represent particular interests in cases or matters that imply a conflicts of interest, or of public policy, between the executive agency and the particular interests it represents.-----

Contractor shall furnish a sworn statement to the effect that neither Contractor nor any president, vice president, executive director or any member of a board of officials or board of directors, or any person performing equivalent functions for Contractor has been convicted of or has pled guilty to any of the crimes listed in Article 6.8 of Act 8-2017, as amended, known as the Act for the Administration and Transformation of Human Resources in the Government of Puerto Rico or any of the crimes included in Act 2-2018.-----

Contractor hereby certifies that it has not been convicted in Puerto Rico or United States Federal court for under Articles 4.2, 4.3 or 5.7 of Act 1-2012, as amended, known as the Organic Act of the Office of Government Ethics of Puerto Rico, any of the crimes listed in Articles 250 through 266 of Act 146-2012, as amended, known as the Puerto Rico Penal Code, any of the crimes typified in Act 2-2018, as amended, known as the Anti-Corruption Code for a New Puerto Rico or any other felony that involves misuse of public funds or property, including but not limited to the crimes mentioned in Article 6.8 of Act 8-2017, as amended, known as the Act for the Administration and Transformation of Human Resources in the Government of Puerto Rico.-----

PREPA shall have the right to terminate the Contract in the event Contractor is convicted in Puerto Rico or United States Federal court for under Articles 4.2, 4.3 or 5.7 of Act 1-2012, as amended, known as the Organic Act of the Office of Government Ethics of Puerto Rico, any of the crimes listed in Articles 250 through 266 of Act 146-2012, as amended, known as the Puerto Rico Penal Code, any of the crimes typified in Act 2-2018, as amended, known as the Anti-Corruption Code for a New Puerto Rico or any other felony that involves misuse of public funds or property, including but not limited to the crimes mentioned in Article 6.8 of

Act 8-2017, as amended, known as the Act for the Administration and Transformation of Human Resources in the Government of Puerto Rico.-----

ARTICLE 48. Correlation of Documents

In case of discrepancy or in the event of conflict among the different Contract documents such as: Contract, Special Conditions, Technical Specifications, Drawings, Proposal Forms, and the Contractors Bidding Proposal, these shall take precedence in the order given.-----

The terms and conditions contained in the Contract shall prevail over any conflictive terms and conditions contained in the Contractor's Bidding Proposal. -----

ARTICLE 49. Transformation Process

The Parties acknowledge that PREPA is undergoing a transformation process, and therefore, both Parties agree that in the eventuality of the execution of a Partnership Contract, Sale Contract or any other PREPA Transaction (as these terms are defined in Act 120-2018), PREPA may sell, assign, convey, transfer, pledge, mortgage, sublease, delegate, hypothecate, or otherwise dispose (each, a "Transfer") any of its rights, title, or interest in this Agreement as permitted by applicable law and at any time, and without Contractor's consent or cost, expense or incremental liability to PREPA, to any future operator of Puerto Rico's electric power transmission and distribution system or any of its affiliates, or to any governmental agency, body, public corporation or municipality of Puerto Rico; provided, that PREPA shall notify Contractor no later than thirty (30) days before the effective date of any such Transfer.-----

ARTICLE 50. Provisions Required Under Joint Memorandum 2017-001 of the Governors Chief of Staff and the Office of Management and Budget

- (1) Both contracting parties acknowledge and accept that the contracted services may be rendered to any entity of the Executive Branch with which the contracting entity enters into an interagency Contract with or as determined by the office of the Chief of Staff. These services shall be rendered under the same terms and conditions with respect to work hours and compensation, as set forth in this Contract. For purposes of this provision, the term "entity of the Executive Branch" includes all agencies of the Government of Puerto Rico as well as all instrumentalities and public corporations. -----
- (2) The office of the Chief of Staff shall have the authority to terminate this Contract at any time.-----

San Juan Steam Plant
Fuel Oil #6 Service Tank S-10 Rehabilitation
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ARTICLE 51. Complete Agreement

This document, together with all attachments referenced herein, constitutes the complete agreement between the Parties. -----

IN WITNESS WHEREOF, the Parties hereto have executed this Contract this _____ day of _____ of the year _____, in San Juan, Puerto Rico.

PUERTO RICO ELECTRIC POWER
AUTHORITY OF PUERTO RICO

CONTRACTOR

BY: _____
José F. Ortiz Vázquez
Chief Executive Officer/Executive Director
Social Security Number 660-43-3747

BY: _____
Name
Title
Social Security Number

SECTION 15010
SPECIAL CONDITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This section includes: PREPA drawings, general contract provision, supplementary conditions, inspection reports and other technical sections.

a) Inspection Reports

TEAM Industrial Services, Inc.

TK-S10 Internal Visual and Ultrasonic Inspection Report (April 4, 2017)

- B. The following additional sections are part of this specification:

- a) Section 09900 – Paint
- b) Section 15455 – Storage Tank
- c) Section 15456 - Hazard Material Procedure Handling
- d) Section 15457 – Confined Space

- C. Whenever in these specifications there are listed specific brands and models of products, it will be understood as equal or approved equal to said products.

1.2 SUMMARY

- A. Scope of work: Work shall include all labor, materials, equipment, tools, supervision, and services for the rehabilitation SJSP Fuel Oil #6 Service Tank S-10 internal and external surfaces. All the required work will be at the San Juan Steam Plant facilities, except otherwise noted. Contractor shall be responsible for all required rigging and safety. Also, the contractor shall be responsible for the appropriate stores of the coatings, grit blast material and equipment.
- B. All works shall be performed in a safe and workmanlike manner and in conformance with Codes, Standards, Local Rules, Regulations and Ordinances, etc. of government agencies having jurisdiction, including but not limited to the following:

- a) The Environmental Protection Agency (EPA).
 - b) The Office of Safety and Health Administration (OSHA) requirements.
 - c) ACI -318 (latest revision).
 - d) Environmental Quality Board
 - e) American Petroleum Institute API - 2610 Design, Construction Operation, Maintenance & Inspection of Terminal and Tank Facilities.
 - f) NFPA-30- Flammable and Combustible Liquid Code
 - g) 29 CFR 1910, 40 CFR 112 (latest revision)
 - h) American Society for Testing and Materials, ASTM.
 - i) EPA NPDES Permit for San Juan Power Plant.
- C. All analysis shall be made by a PREPA approved laboratory.

1.3 REQUIRED DOCUMENTS

- A. Bidders shall submit evidence of required experience of at least three (3) years in related works. The required experience shall be a list of similar projects (past or ongoing) where the following conditions are or were met:
- a) Full enclosure of working area
 - b) Sandblasting of metal surfaces and capacity (CFM) of the compressor used for the work.
 - c) Use of airless spray or plural component equipment. Specify if equipment was rented or own by the company.
- B. Contractor shall provide a work schedule for the project. This schedule will be reviewed and approved by the Engineer prior to commencing work.
- C. Material Safety Data Sheets (MSDS) of all chemical products required for the project shall be submitted for approval to the Hazard Communication Section at the Safety Division of PREPA. Once approved the Contractor shall keep a copy of the MSDS on the site.
- D. Contractor shall provide submittals for the products specified in each of the Technical Specifications.

- E. The Contractor shall provide any technical reference manuals or operational and maintenance information available, for any equipment being installed.
- F. Contractor shall submit for evaluation, a site specific Work Plan, including how to comply with the applicable environmental, safety and health regulations. Before the commencement of work, the Contractor shall participate in a meeting with PREPA's Safety Officer and the Project Manager, for a job briefing and a visit to the work area.
- G. Contractor shall submit results of all laboratory tests required.

1.4 RECORD DRAWINGS

- A. Contractor shall keep, at the site of work, a complete set of drawings for the purpose of noting thereon on a continuous basis, all field changes during construction. Changes will be marked in red.
- B. This set of provisional record drawings will be kept up to date with all changes noted thereon, and they shall be submitted for the inspection and approval of the Engineer, when requested.
- C. Upon termination of the installations, record drawings will be delivered through the Engineer to the Design and Drawing Department showing all as-built condition before final liquidation of Contract.

1.5 GENERAL REQUIREMENTS

- A. It is the responsibility of the Contractor to coordinate with the Engineer the presence of any underground existing facilities, such as electrical conduits, cables, fuel lines, water lines, etc., which could be affected during construction.
- B. Contractor shall coordinate with the site's Operations Manager and with the Engineer the schedule for performing works as specified and required.
- C. Maintaining site operations is a priority for PREPA, so it shall be considered as an essential condition of this contract. As such, contract works cannot expose conflict with normal plant and is the responsibility of the Contractor to coordinate with the Engineer a work program that provides normal operation of the site during project progress.

The operational scheme for site operations relies solely on PREPA, so any order by PREPA to stop contractor works or any delay related to PREPA granting availability of any area, equipment or material shall be considered as a foreseeable event.

- D. In the event contractor is unable to perform works due to any operational, maintenance, security or safety related determinations by PREPA, contractor's only remedy shall be an extension of time for performing his contract obligations.
- E. Contractor works to be performed close or adjacent to any facility or equipment in service shall be coordinated with the Engineer and the site's Operations Manager. Full access to PREPA personnel to all areas in service or available for being in service shall be guaranteed at all times by contractor.
- F. Before start working the Contractor shall meet with designated health and safety personnel to establish specific safety and health precautions.
- G. It is the intention of these specifications and drawings to develop the work until the project is completed. That the necessary tests are done and the system is left operational. The Contractor is responsible for any details that usually are not found in the drawings or specifications provided by PREPA, as there shall be a final design, certified issued for construction drawings under the full responsibility of the Contractor and approved by PREPA. Said details shall be included in the work, just as the ones specified and shown in the drawings.
- H. The Engineer can reject all materials and work done by the Contractor not according to the provided drawings, specifications or contract. The Contractor will replace all the material and perform the necessary labor to correct the work or rejected material at his own cost, to the Engineer's satisfaction.
- I. If any errors or omissions occur, the Contractor shall notify the Engineer prior to submitting his proposal, so the necessary revisions or adjustments are made.
- J. It is the Contractor's responsibility to certify that documents submitted for approval does not deviate from the contract specifications. Any deviation or change not indicated in writing by the Contractor should automatically invalidate PREPA's seal of approval for that particular document.
- K. All work performed under these Specifications shall be done in a safe and workmanlike manner and in strict conformance with all local rules regulations and ordinances, etc. The Contractor shall use all necessary safety equipment, such as reflected jackets, safety cones, and safety warnings at the work site near road areas and vehicle traffic.
- L. All proposals must be completed in the prescribed format for the purpose of

basic comparison and evaluation. Additional or separate data, however, which each Bidder may wish to present for clarification or amendment will be accepted without prejudice to the basic proposal, and will be considered in its applicable context.

- M. It shall be the Bidder's singular and sole responsibility to visit the job-site and to acquire whatever data is necessary for preparation of his/her Bidder's proposal, to meet the obligations and warranties to the Authority, as detailed in these Specifications. This activity shall be accomplished at the Bidders own initiative, time and expense, and at no charge or expense to the Authority. Prior to submitting a proposal, the Contractor informs himself of all local conditions which might affect his performance of the work. Such conditions shall include, but are not limited to: site operation schemes and procedures, workmen's facilities, location of central points, access to the site, available utilities, and disposal areas of excavated materials, uncertainty of weather (including historic weather data), and all other contingencies.

1.6 TEMPORARY FACILITIES

A. Contractor's Field Office

- a) The Contractor's field office shall be of such construction as approved by the Engineer. A temporary telephone shall be installed and maintained during the extent of the construction time by the Contractor. The Authority shall issue orders and directions to the Contractor at this field office.
- b) The location of the construction offices and the preparation of the general area will be as specified by the Engineer.
- c) The Contractor shall maintain proper communication between his field office and his field personnel. Failure to maintain said communication shall be considered just cause to withhold any or all payments due to the Contractor until said communications are restored.

B. Light and Power

- a) The Contractor shall furnish and install immediately upon the start of the work and shall maintain for the duration of the construction period, adequate temporary light and electric power as required, for his own use and for the use of all trades, subcontractors, and separate contractors, in connection with the work. This installation shall be made in accordance with the National Electrical Code and as directed by the Engineer.
- b) The Contractor shall provide at his expense for all electric power

consumed for the illumination, power testing of all equipment, and other fringe expenses and service charges.

C. Sanitary Conveniences

- a) The Contractor shall provide temporary sanitary conveniences for use of the Contractor's employees and the employees of all trades, subcontractors, and separate contractors at the site and maintain them in a sanitary condition until the completion of the work. Said facilities shall meet the approval of the Puerto Rico Board of Health.

D. Water

- a) The Contractor shall make the necessary arrangements and provide all water required during the entire construction period. The cost for temporary water shall be borne by the Contractor, except for that used in the hydrostatic test. Also shall prevent the use of water for cleaning purposes. The uses of dry cleaning techniques (absorbents wipe and vacuum) are necessary for the pollution potential of the NPDES discharges. This is a BMPP requirement.
- b) Under any circumstance the liquids will be discharge to the ground. This includes purge lines before any repair. There will not be any discharge of chemical products and hydrocarbons to the discharge system, not to cause any deviation to the NPDES permit.

E. Scaffolds, Staging, and Safety Devices

- a) The Contractor shall provide, erect, maintain, and remove when directed, all scaffolding, staging platforms, temporary turn ways, temporary flooring, guard railings, stairs, etc., as required by local and state codes, or laws, for the protection of workmen and the public.
- b) The construction, inspection, and maintenance of the above items shall comply with all safety codes and regulations as applicable to the project.

F. Access to Facilities

- a) Maintain at all times all access roads to the project reasonably free of accumulated mud and/or debris. Special note must be taken to the fact of little space availability. The Contractor shall note this and program his site activities accordingly. Additional space if need will be provided by the Contractor at his cost in other facilities.

1.7 STANDARDS FOR EQUIPMENT AND MATERIALS

- A. All materials and equipment described or found necessary for the installation shall be new, free from defects, and shall be listed by Underwriters Laboratories, Inc., and by the American Water Works Association as conforming to their standards in every case where such standard has been established for the particular type of material in question. The Engineer shall approve all materials and equipment.
- B. Equipment and materials shall be properly stored, protected and carefully handled, following the manufacturer's recommendations, to prevent damage before and during installation. Damaged or defective items shall be replaced at no cost to PREPA.
- C. Any equipment, material or work performed without the Engineer's approval or in disagreement with the drawings, specifications or the contract, may be rejected. The Contractor shall replace or repair rejected equipment or labor at his expense as recommended by the Engineer.
- D. The Contractor shall furnish the services of an experienced licensed Engineer who shall constantly be in charge of the work together with skilled workmen, fitters, helpers, and labor required to properly unload, transfer, erect, connect, adjust, start, operate, and test the system. Work shall be performed in a workmanlike manner, shall present a neat and mechanical appearance when completed, and shall be subject to the approval of the PREPA.
- E. Materials or equipment to be supplied by the Contractor shall be subject to the approval of the Engineer. Valves and piping shall be from U.S. Manufacturers.

1.8 PROGRESS REPORTS

- A. Contractor shall submit to the Engineer a monthly progress report with the following information:
 - a) Dates of completion for activities that have been completed since the last report.
 - b) Days remaining for in-progress activities.
 - c) Changes to reflect variations from or modifications to the original network plan.
 - d) Project progress evaluation with identification of problem areas.

- e) Recent photographs showing the work in progress.
- B. At least once a month the PREPA will compare the progress information with the Master Schedule. He will present the results at a progress review meeting with the Contractor, with identification of problem areas, if any.
- C. Contractor shall submit to the Engineer his purchase order numbers, dates, description of the materials involved, and the delivery dates specified. Such information is to be submitted at monthly intervals so that the Engineer will be cognizant of the progress being made by the Contractor in the placing of orders.

1.9 FORCE ACCOUNT

If the Engineer and Contractor are unable to negotiate a price for any Changes and/or Extra Work in accordance with ARTICLE 10 Changes and/or Extra Work of the TERMS AND CONDITIONS the Engineer may direct the Contractor to perform all or part of the revised Work on a force account basis. When the Engineer directs the Contractor to perform revised Work on a force account basis, PREPA will pay the Contractor as specified hereon:

A. Labor

PREPA will compensate the Contractor for labor at the actual rate of wage paid and shown on the payroll for every hour that the labor and foreman are actually engaged in the revised Work, plus an additional 15 percent for field and home office overhead costs and profit.

The foreman must be in direct charge of the specific operations and must be at the Project Site in order to be included in this compensation. Unless already included in the wage rates paid, the Contractor will also receive the actual labor-related costs incurred by reason of subsistence and travel allowances, health and welfare benefits, pension fund, or other fringe benefits, provided those payments are required by collective bargaining agreement or other employment contract generally applicable to the classes of labor employed on the Work.

The Department will prorate the wages of any foreman who is employed partly on the revised Work and partly on other Work. The Department will determine the prorated wage based on the number of workers employed on each class of Work as shown by the payrolls. The Department will prorate any subsistence or travel allowances paid to the foreman on the same basis as the prorated direct wages.

B. Materials

PREPA will pay the Contractor the actual cost of acceptable Materials delivered and used in the revised Work, including transportation charges paid by the Contractor (exclusive of equipment rentals), plus an additional 15 percent for field and home office overhead costs and profit.

C. Equipment

PREPA will pay the Contractor for Equipment at the rental rates agreed by both parties and effective on the date the two parties execute the force account agreement. This compensation is for Equipment, fuel, and lubricants, transportation that the Engineer authorizes and the Contractor uses on the Project, plus an additional 15 percent for field and home office overhead costs and profit. PREPA will not pay for small tools. PREPA will pay for the actual time the Equipment is in operation on the revised Work, plus travel time or transportation allowances.

If the Equipment is moved to and from the location of the revised Work under its own power by PREPA's request, PREPA will pay for the travel time at the above rental rates.

1.10 DELIVERY, HANDLING AND STORAGE

- A. Products will be delivered to the project, properly identified with name, type, and other necessary information for its identification.
- B. Contractor will be responsible for the delivery, unloading, storage and handling of the materials or equipment to be used in the project, and maintaining them in optimal conditions.
- C. Materials will be stored in an adequate area that satisfies the Engineer. The storage area will remain clean, in optimal conditions and free of hazards.
- D. Contractor will coordinate site storage and rubbish disposal areas with the Engineer.
- E. Equipment will be packed in suitable crates and boxes. Straps will be provided for full protection of equipment from damage during transit.
- F. Protect stored pipes, fittings, flanges and valves from moisture and dirt by covering with durable, waterproofing tarpaulins if necessary.

1.11 SAFETY PROVISIONS

- A. The Contractor shall comply with the following minimum requirements of a health and safety program:

- a) The plan shall have its own loss control program.
 - b) It shall include an accident or incident investigation procedure.
 - c) It will describe procedures for compliance with requirements of all applicable regulations included in the 29 CFR. The Program latest revision date shall not be greater than a year from the projects commencement date.
- B. The PREPA's auditing committee shall approve the program, as a requirement to be included in the Evaluated Suppliers Registry.
- C. Plan shall include the following:
- a) Plan shall include contingency procedures that include how to proceed in an emergency situation, during an accident, in case of an atmospheric disturbance, in case of fire and spill.
 - b) Copy of all training certificates, licenses or certifications required, according to the scope of work. For example: pesticide applicator, electrician, spill responder, refrigeration technician, DOT training for hazardous substances, etc.
 - c) Copy of the Material Safety Data Sheets (MSDS) of all chemical products to be used during the project, for evaluation and approval by the Occupational Safety and Health Office at PREPA (Hazard Communication Section). All chemical products must be approved by PREPA.
- D. Services including the application of chemical products within closed spaces, like buildings, will be offered between Monday and Saturday AFTER PREPA's WORKING HOURS. The Contractor will take all steps necessary to assure the area will be free of nuisance odors or vapors before PREPA personnel is to reoccupy. All these will be done in coordination with the local supervisor of PREPA. Services in exterior parts of PREPA can be done during regular working hours.
- E. The Contractor shall assure that all wastes are removed and properly disposed of, in accordance with all applicable laws and regulations, after completion of work. Any remaining construction material shall be removed from PREPA facilities within 24 hours. If the contractor not able to dispose of the materials it shall move to an area protected from the elements.
- F. Before commencement of work, the Contractor shall take part in a coordination meeting with a Safety Officer, an Environmental Control

Supervisor and the project manager on PREPA's behalf. During this meeting the site-specific work plan will be discussed and reviewed, including the safety rules and the environmental protection procedures to be followed. Also, a tour of the areas to be worked on will take place.

- G. All chemical products to be used shall be classified as Approval or Conditionally Approval by PREPA's Substances and Waste Management Department and Hazard Communication Section.
- H. Welding operations will comply with the requirements of OSHA, ANSI and NFPA.
- I. If the project involves the handling of non-asbestos insulation or other dust generating materials, like gypsum board, steps shall be taken to prevent the release of the dust to adjacent areas.
- J. The Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to, all employees on the work and all other persons who may be affected. Also to the work, property, material and equipment on or off the site, under the care, custody or control of the Contractor or any of his subcontractors.
- K. The Contractor shall comply with all applicable laws, ordinances, rules, regulations and lawful orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. He shall erect and maintain, as required by existing conditions and progress of the work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.
- L. The Contractor shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents, who shall develop and coordinate with the Safety Officer a safety program. This person shall be designated to execute only this duty. He also has the responsibility of conduct and take record of the weekly security meetings with the Contractor's employees involved in the required works and to report all accidents or incidents occurred during the project duration.
- M. Compliance with all safety provisions by subcontractors shall be the responsibility of the Contractor.
- N. Contractor agrees that it shall perform all work in compliance with federal, state and local occupational safety and health regulations, including but not limiting to hazard communication, and right-to-know laws. In addition, the Contractor agrees to observe the compliance of all precautions stated upon the applicable materials safety data sheets and container labels of all

chemicals used in the contracted work.

- O. Contractor will obtain and maintain, during the duration of the contract, the proper permits from all federal, state and local regulatory authorities or other applicable government agency with respect to discharge, disposal, use, storage, handling and transportation of hazardous chemicals and substances as and when applicable law or regulation requires. For projects including the handling of asbestos, lead, or spilled hazardous substances, the notification to EPA or the EQB will be done by the Contractor, but in coordination with the following PREPA personnel: Safety Officer, Environmental Control Supervisor and the Substance and Waste Management Department.
- P. Contractor will not cause or permit any hazardous chemical or product containing a hazardous chemical to be at, or in the vicinity of, any place where any employee, agent, or contractor of Puerto Rico Electric Power Authority, or any employee of any such agent or Contractor, may be at risk or exposed to hazard as a result thereof during normal use or any foreseeable emergency.
- Q. Contractor will defend, indemnify and hold harmless, Puerto Rico Electric Power Authority, its employees, agents or assigns for any and all direct liabilities and expenses arising out of noncompliance with safety provision clauses, irrespective of any other terms of this agreement.
- R. Puerto Rico Electric Power Authority may unilaterally terminate this contract upon Contractor's nonobservance of any of the foregoing or for any failure to comply with any of the safety provisions on this Contract upon thirty (30) days of a written notice to Contractor.

1.12 ENVIRONMENTAL PROTECTION CONDITIONS

- A. The Contractor shall exercise every reasonable precaution throughout the life of the project to prevent silting of rivers, streams, sea, ocean, lakes and reservoirs. Construction of drainage facilities as well as performance of other contract work, which will contribute to the control of settlements, shall be carried out in conjunction with earthwork operations or as soon thereafter as is practicable.
- B. Unless otherwise approved in writing by the Engineer, construction operations in rivers, streams, lakes and reservoirs shall be restricted to those areas where channel changes are shown on the plans and to those areas that must be entered for the construction of temporary or permanent structures. Rivers, streams, lakes and reservoirs shall be promptly cleared of all false work, piling, debris, or other obstructions placed therein or caused by the construction operations. Frequent fording or live streams with construction equipment will not be permitted. Temporary bridges or other

structures shall be used wherever an appreciable number of stream crossings are necessary.

- C. Unless otherwise approved in writing by the Engineer, mechanized equipment shall not be operated in live streams except as may be required to construct channel and temporary or permanent structures. The Contractor shall exercise every reasonable precaution throughout the life of the project to prevent pollution of rivers, sea or ocean streams, lakes or reservoirs.
- D. Pollutants, such as chemicals, fuels, lubricants, bitumen, raw, sewage and other harmful waste shall not be discharged into or alongside of rivers, streams, seas, oceans, lakes or reservoirs or into natural or manmade channels leading thereto. The Contractor shall also comply with the applicable regulations relating to the prevention and abatement of water, air and noise pollution among others. The Contractor shall be liable for any fines imposed to PREPA due to the Contractor's noncompliance with any federal or local environmental regulation.
- E. The Contractor agrees to indemnify PREPA for all direct liabilities and expenses arising out of any claim due to an environmental violation, caused by his enterprises during the performance of the contract or by nonperformance of its obligations under the contract.
- F. The Contractor should have available, close to the working area, the necessary equipment to control and pick up any spilling that could occur, during the performance of the work required by the contract. The equipment should include the necessary for the waste disposal.
- G. All equipment to be used in the work area should be free of oil, transmission fluid or hydraulic fluid leakage. If the equipment develops a leakage during the work process, it should be repaired out of the PREPA site or replace immediately.
- H. The Contractor should dispose of all garbage generated because of this work, according to the environmental regulations. The use of PREPA's garbage disposal equipment is not permitted. The removed materials shall be disposed as soon as possible (less than 24 hrs.) in order to avoid exposed materials at open areas. If the materials can't be disposed immediately, the Contractor shall move the materials to a contained and non-exposure area.
- I. Any Chemical product to be used shall be classified Approved by PREPA's Hazard Communications Section before entering the work area of PREPA's premises.
- J. The Contractor shall protect all chemical products to be used against rain or

any other weather conditions. Prior to the use of any chemical product, the United States Environmental Protection Agency (USEPA), has to approve the discharge of any toxic substance under the NPDES Permit for each facility. Discharge of any product under the Federal Insecticide, fungicide and Rodenticide Act is prohibited unless specifically authorized under the NPDES Permit. The assistance includes, and is not limited to, any information regarding the process, products and technical issues under EPA's evaluation.

- K. The Contractor shall avoid contaminating air, soil or water with chemical substances or waste material generated because of his work.
- L. As a part of best management practice, the Contractor shall avoid the use of water for cleaning purposes. The use of dry cleaning techniques (absorbents or vacuum cleaning) is necessary to avoid the potential contamination of the NPDES discharges. Also follow the section 12.0 of the Storm Water Pollution Prevention plan (SWPPP) for San Juan Power Plant. The SWPPP is a requirement of NPDES permit.
- M. All chemical analysis shall be performed by a laboratory included in PREPA's Material Management Division Supplier's Register as companies properly qualified and evaluated by PREPA's Quality Assurance Department to perform this type of work. Prepa's personnel will audit the sampling and disposal of waste material.
- N. "The disposal of hazardous waste material (if any) shall be done in a PREPA approved Treatment, Storage, Disposal Facility (TSDF).
- O. The Contractor shall comply with all environmental laws and regulations related to water, soil and air quality.
- P. The Contractor shall comply with all arrangements established in the Consent Decree between PREPA and Environmental Protection Agency.
- Q. All work shall be performed according to the Storm Water Pollution Prevention plan (SWPPP) for San Juan Power Plant, which is part of the Special Conditions of the NPDES permit.
- R. The Contractor will be held responsible for any NPDES violations and its related costs if the violations are related to the Contractor's activities.
- S. The Contractor shall submit evidence of compliance with 49 CFR 172 Subpart H (DOT).
- T. All work shall be performed according to Section 13 of the Storm Water Pollution Prevention Plan (SWPPP) for San Juan Power Plant. (Section 13.0

- Contractor Practices and Procedures), included as follows:

- a) Contractors are potential sources of contamination in storm-water and process wastewater because of the wide variety of materials used and the non-routine nature of their work. However, contractors must adhere to the PREPA policies regarding maintenance practices, operations practice, good housekeeping, training, materials compatibility, condition of equipment, and materials handling.
- b) A routine part of a Contractor's is SWPP training. Each Contractor must confirm that its employees are properly trained in environmental and safety principles and pertinent plant policies. Non adherence to these policies can result in dismissal of a Contractors employee or the entire Contractor Company.
- c) Specific controls on Contractor activities include:
 - SWPPP training at Contractor orientation.
 - Documentation of materials brought on site by the Contractor. Contractor must identify materials and amounts in their working plans. Also, Contractor must remove all unused material from the site at the completion of the project.
 - Contractor's equipment must be in good working order. Equipment with broken or defective parts or oil leaks will not be allowed on site.
- U. It is necessary to avoid the development of a new storm-water discharge point as a consequence of the construction activities. These activities shall not cause any violations to the NPDES Permit Discharges.
- V. The Contractor shall submit, for evaluation by the Environmental Control Supervisor, a copy of a Site Specific Work Plan. The Plan shall include any other regulation or guideline applicable to the scope of work, and shall include a contingency plan which includes how to proceed in an emergency situation, such as: an accident, an atmospheric disturbance, hazardous chemical substance spill, a fire and others.
- W. The Contractor shall inform and coordinate with the Environmental Control Supervisor of any work to be done to avoid any environmental violation.
- X. Before starting the work, the Contractor shall submit, for evaluation by the Environmental Protection and Quality Assurance Division, a copy of a Site Specific Work Plan.

- Y. The Contractor, upon completion of the work, must leave all work areas clean, organized and free of contaminants, according to the laboratory analysis, before and after the work. The storage area for the removed equipments and parts must be appropriate to avoid contaminants dispersion to the ground or water.
- Z. Temporary areas of construction and disposal materials shall be areas protected with dikes. In the absence of dikes, the Contractor shall prepare temporary areas with dikes to avoid materials exposure.
- AA. When using portalettes, the Contractor is responsible for the location of these in diked protected areas to prevent and avoid any sanitary discharge thru the power plant premises. It is prohibited to clean or wash the portalettes within the power plant premises.

PART 2 PRODUCTS

- A. All products in this project shall be approved by PREPA prior entrance to the property.
- B. Whenever in these specifications there are listed specific brands and models of products, it will be understood as equal or approved equal to said products. A five days' period after the order to proceed will be allow for the contractor to submit alternate products, beyond this period the contractor shall provide the approved models.

PART 3 EXECUTION

3.1 REQUIRED WORK

- A. The required works will be based on the global cost of the project. These will be coordinated and integrated to obtain a uniform job stream. The works required the rehabilitation of the Fuel Oil #6 Service Tank S-10.
- B. New anchors design calculation shall be performed using API-650 latest edition and using a Seismic Use Group III (SUG III), Importance factor (I) of 1.5. Contractor shall include the installation of any additional anchor based on the calculation results.
- C. Repair undercut (0.250") at the internal manual level pipe support as per API-653 section 9.6. Refer to Annex 3 – Tank Inspection Report, section 4.3 and bottom right picture on page 35.
- D. Repair bottom plate #4 with a 24" x 12" welded on plate as per API-653 section 9.3. Refer to Annex 3 – Tank Inspection Report, section 4.6 and

bottom right picture on page 39.

- E. Repair undercut (0.500") at nozzles N3 (4"Ø) as per API-653 section 9.6. Refer to Annex 3 – Tank Inspection Report, section 4.7 and top right picture on page 34.
- F. Replace ten (10) stairway steps identical to the existing ones.
- G. Replace twenty (20) stairway steps support bars identical to the existing ones.
- H. Replace the stairs top landing platform.
- I. Replace the two roof nozzle flanges located adjacent to the top platform and also their corresponding mate flanges. All gaskets, bolts, nuts and washers shall be replaced.
- J. Replace the existing illumination system including wiring, conduit, poles and luminaires.
 - a) Conduits shall be PVC coated galvanized steel. Approved model Plasti-Bond REDH2OT.
 - b) Pole shall be hot dipped galvanized.
 - c) Luminaries (3) shall be high power LED explosion proof for pole mounted application. All luminaries shall have an output of 16,000 lumens. Product shall be certified and wear IP66, Ex, ATEX, RoHS and CE markings. Applicable for gas explosion zone 1, zone 2 and zone 21, zone 22 dust explosion. Rated frequency of 60 Hz and input voltage 90-305 VAC. Approved model Tormin BC9700-L150.
- K. Provide a new tank reconstruction nameplate in accordance with API-653 section 13.1
- L. Install a new float and tape transmitter for tank level measuring. Approved model: Varec 2920 FTT with HART communication protocol.
- M. Install a new liquid level indicator (target and gauge board). Approved model Varec 6700 Liquid Level Indicator.
- N. Scope shall include the installation of 10 (12" x 12") insert plates for roof or shell repairs, total of 10 ft² of repair plate area. Bidders shall include unit price for these repair plates for additive/deductive.
- O. Scope shall include the installation of 10 (12" x 12") lap patches for bottom

repairs, total of 10 ft² of repair plate area. Bidders shall include unit price for these repair plates for additive/deductive.

- P. Scope of work shall include 20 linear feet of shell to bottom weld repair (or any butt weld) and 20 linear feet of bottom weld repair (or any fillet weld). Bidders shall include unit price for these repair welds for additive/deductive.
- Q. All flanges shall be refitted with new gaskets, bolts, nuts and washers.
- R. After coating removal all bottom and shell to bottom welds shall be vacuum tested.
- S. All telltale holes shall be cleaned and pneumatically tested.
- T. All scaffolding shall be inspected, certify and tagged with the corresponding labels.
- U. Grit blast media (black beauty) used to remove the existing coating shall not be recycled for final surface profile preparation to avoid surface contamination. Recycle material shall be pass thru a screening device and heated to remove any humidity. The contractor shall be responsible to avoid this situation using its preferable method. In most cases the surface can be prepare as final with only one pass of grit blasting. PREPA does not require two separate grit blasting, if surface conditions are met with one pass.
- V. All coating products shall be applied using a single or plural component airless system. Brushes and rollers will ONLY be used for initial stripe coat of all seams, corners and all the top weir channels.
- W. Construction and consolidated permits will be required for this project.
- X. The Contractor shall be responsible for the removal and disposal of the sand or media used for the blasting of the tank's interior and exterior surfaces. This material (blasting media) must be Non-Hazardous.
- Y. The Contractor/Subcontractor must be certified on the use or application of the specified coating systems. The Contractor must present an original certification signed by the coating manufacturer or official local representative stating that the employees performing the mixing and application of the coating systems were formally instructed in such procedures, specifically in the product used. Local firms shall present a current letter of representation from the manufacturer.
- Z. Besides the coating work on the tank interior and exterior shell, the Contractor shall paint up to the next flange face and all welded support structure. Railings, gratings and stairs shall also be included as part of this

scope of work.

AA. Stripe coat requirement for paint layers:

- a) Interior surfaces – Only before primer coat
- b) Exterior surfaces – Before each coat

BB. Lead content is not expected in the existing coatings of the Fuel Oil #6 Service Tank S-10.

CC. Cleaning

- a) The tank shall be subjected to a pressured water cleaning (5,000 psi minimum) using a solution of potable water and Chlor-Rid in a dilution of 1:100. This procedure shall be applied to all internal and external surfaces of the tank.
- b) Surfaces shall be tested for contaminants before any rehabilitation or surface preparation. Cleaning as described in the preceding item shall be repeated if contamination levels are founded to be greater than the followings:
 - i. Chlorides > 20 mg/m² (2 µg/cm²)
 - ii. Sulfates > 20 mg/m² (2.5 µg/cm²)
 - iii. Nitrates > 25 mg/m² (2.5 µg/cm²)

DD. Final Surface Preparation (Refer to Specification 09900)

- a) Interior – Surface Preparation #1, white metal (SSPC-SP5).
- b) Exterior – Surface Preparation #2, near white (SSPC-SP10). **Requires 100% tank encapsulation.**

EE. Coating, Lining and Repair System (Refer to Specification 09900)

- a) Interior (100% of Surfaces) - Coating System 4
- b) Exterior (100% of Surfaces) - Coating System 1

FF. Tank bottom to concrete base edge shall be sealed with *Sikaflex-1a* polyurethane elastomeric sealant.

GG. Contractor shall prepare test coupons as part of the quality control program. These coupons shall be prepared during initial, intermediate and final stages of the Work. PREPA will require 3 coupons for interior and 3 for exterior.

Each coupon shall reflect all stages of the coating process. PREPA will use these coupons for pull-off (adhesion) testing. Coupons material shall be carbon steel with a 12" x 12" x 1/4" size. A PREPA's inspector shall witness test coupon preparation process.

- HH. The ID Plate shall be smooth sating matte finish Aluminum 5052 or 6061, with 1/8" thickness and engraved lettering. Other acceptable material will be Stainless Steel 304 or 316.
- II. All interior surfaces (100%) shall be subject to a High Voltage Holiday Spark Test.
- JJ. Contractor shall keep record of the following information (Contractor could use the provided drawings of the tank for this requirement):
 - a) Coating production batches and the location where it was applied.
 - b) Name of the painter and personnel in charge of the mixing.
 - c) Date, weather conditions and substrate conditions.
 - d) Surface profile.
 - e) Application Method.
 - f) Coating thickness (WFT & DFT)
- KK. Surface profile tests shall be performed with a digital gauge similar to Elcometer 224.
- LL. Manual version of the PosiTest AT-M will be allowed for adhesion testing.
- MM. The Contractor is not required to have a NACE inspector on-site for the project duration. Nevertheless, a weekly report from a NACE inspector during surface preparation and coating application period shall be delivered to PREPA on every construction meeting with the PREPA's project manager.
- NN. Contractor shall prepare and install an identification plate (24" x 24") with the following information:

DATE: CONTRATOR: PREPA PO:

INTERIOR COATING:

SURFACE PREPARATION: PROFILE:
PRIMER: THICKNESS (DFT):

BASE:
FINISH:

THICKNESS (DFT):
THICKNESS (DFT):

EXTERIOR COATING:

SURFACE PREPARATION:
PRIMER:
BASE:
FINISH:

PROFILE:
THICKNESS (DFT):
THICKNESS (DFT):
THICKNESS (DFT):

OO. Colors

a) Interior

- i. Base: Red
- ii. Finish: Gray

b) Exterior

- i. Primer: Green
- ii. Base: Aluminum Grey
- iii. Finish: White

PP. Contractor shall follow Annex 1 for tank identification.

QQ. Contractor shall follow the requirements of API 650, section 7.3.6 (Hydrostatic Testing Requirements).

RR. Water connection for the hydrostatic test will be approximately 150 ft. from the tank.

SS. The filling rate will be 45,000 gallons per 8 hr. shift. PREPA will allow filling the tank only 1 shift per day (regular shift).

TT. The discharge location for the hydrostatic test water should be approximately 150 ft away.

UU. Contractor shall consider 7 labor days to perform water analysis and to drain the tank.

VV. Contractor shall be responsible to clean the tank before hydrostatic test to avoid water contamination (oil and grease).

WW. Contractor's Project Engineer (with the require certifications) could serves as safety officer. The Project Engineer shall be available to visit the project site at any time during the project and shall visit and supervise the works at least twice a week (8hrs each day). A separate Safety Officer for this purpose is not required. Contractor shall assure the presence of a qualified person at the site throughout the project duration.

XX. Bidders shall consider the application methods established in the specifications for their proposals.

YY. Final tank inspection report is included as Annex #3.

END OF SECTION 15010

Government of Puerto Rico

Puerto Rico Electric Power Authority



Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES
Submittal to COR3 and FEMA



***Unit 5 SCR Ammonium Procurement San
Juan Power Plant***

2/1/2022



Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes
v.1	02/01/2022	



Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	Unit 5 SCR Ammonium Procurement - San Juan Power Plant
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number (Formerly Project Worksheet)	136271 - MEPA078 PREPA Island Wide FAAS Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: <Name>

<Insert title here>

PREPA Project Sponsor: <Name >

<Insert title here>



Section 2. Facilities

2.1. Facilities List

Name	GPS Location
<i>San Juan Power Plant</i> Unit 5 SCR Ammonium Procurement	

Note: GPS coordinates are required for all facilities.

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

For environmental compliance to operate units 5 and 6 at base load with natural gas, the installation of a selective catalytic reduction (SCR) system was established in one of the two units. The catalytic was installed in unit 5 using ammonia 18-19%W/W (SHOULD NEVER EXCEED 19% W/W). It is a requirement to use deionized water.



Section 3. Scope of Work

3.1. Scope of Work Description

The scope of work for San Juan Power Plant - Unit 5 SCR Ammonium Procurement will consist of the following:

Procurement and delivery of Ammonium Substance to be used for the Selective Catalytic Reduction system to control emissions of Unit 5 for compliance of Federal Law.

Procurement to acquire ammonium 18-19 % to be used in the catalytic SCR of the Heat Recovery Steam Generator of the Unit 5 to control the emissions product of the internal combustion of the combustion turbine.

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards:** Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project:** Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
 - a. Other improvements, not required by codes and standards
 - b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate)

If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.

Restores to Codes/Standards

Note: If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.

3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.



Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?

4.1. Codes, Specifications, and Standards

Yes/No. If yes, describe how incorporated below.
<ul style="list-style-type: none"> • (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE) • (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE) • Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730B-2 - U.S. Department of Agriculture Rural Electric Service (RUS) • International Building Code (IBC) - International Code Council (ICC) • International Energy Conservation Code (IECC) - International Code Council (ICC) • International Existing Building Code (IEBC) - International Code Council (ICC) • National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers • National Electrical Code (NEC) - National Fire Protection Association (NFPA) • FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.
<ul style="list-style-type: none"> • 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA) • 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA) • ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE) • International Building Code (IBC) - International Code Council (ICC) • Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA) • Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA) • RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS) • Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.



Cost Type	Amount (\$M)
Procurement & Delivery	\$500,000.00
Total Project Estimated Cost	\$500,000.00

Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: If available, detailed engineering cost estimates will be included as an attachment.

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

Program Manager's Printed Name

Date

Title

Signature

Section 9. PREPA Project Sponsor Comments

Comments
<Insert any comments here>



PREPA Project Sponsor's Printed Name

Date

Title

Signature

Section 10. Attachments

10.1. Project Detailed Cost Estimates

- Please see attached Justification memo and Specifications.

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures



10.4. Other: (Please Describe)

N/A



GOVERNMENT OF PUERTO RICO
PUERTO RICO ELECTRIC POWER AUTHORITY

PROJECT NUMBER: 13

Work Name: Unit 5 SCR Ammonium Procurement

Work Description:

Procurement and delivery of Ammonium Substance to be used for the Selective Catalytic Reduction system to control emissions of Unit 5 for compliance of Federal Law.

Scope of Work:

Procurement to acquire ammonium 18-19 % to be used in the catalytic SCR of the Heat Recovery Steam Generator of the Unit 5 to control the emissions product of the internal combustion of the combustion turbine.

Note: This project is part of the operational costs.

Benefits:



ESPECIFICACIONES

Para el cumplimiento ambiental de operar las unidades 5 y 6 a carga base con gas natural se estableció la instalación de un sistema de reducción catalítica selectiva (SCR, en inglés) en una de las dos unidades. El catalítico se instaló en la unidad 5 y se utiliza la amonía del 18-19%W/W (**NUNCA DEBE EXCEDER EL 19 % W/W**). Es requisito utilizar agua desionizada.

Ammonia Reagent	19% Aqueous solution
Ammonia Reagent Specification	Technical Grade or better, using fully de-ionized water

Requisitos para el contrato:

1. Una vez se llame el contratista tiene hasta un máximo de tres días calendarios para entregar el producto a la Central San Juan. El tercer día es el de entrega.
2. En el mejor de los casos se necesitan 5,000 galones semanales y en el peor son 10,000 galones semanales. El contratista debe cumplir con este requisito.
3. El contratista proveerá toda labor, transportación, supervisión, seguros, herramientas, equipos, materiales, y el personal diestro necesario para la entrega de amonía en la Central San Juan. Se requiere que el chofer tenga la licencia vigente.
4. El contratista y el chofer debe cumplir con todos los requisitos de ley y reglamentaciones para el manejo, venta, transportación y entrega del agua amonía. Además, debe tener la Licencia de Explosivos de PR.
5. Cada entrega incluirá un certificado de análisis, por un químico licenciado y colegiado en PR que demuestre cumplir con todas las especificaciones que se acompañan, incluyendo el requisito de una concentración entre 18 y 19 % w/w (nunca sobrepasará 19%, de ser mayor no se recibirá).
6. El contratista será responsable de conectar y desconectar el camión tanque a nuestro sistema de bombas para recibo, la persona designada por el contratista deberá tener todo el equipo de protección necesario para el manejo de agua amonía al 19 %w/w y el conocimiento necesario.
7. Conexión para entrega de amonía al tanque en fase de diseño. Verificar al momento de presentar propuesta final.

Por lo expuesto, estamos realizando el MR 683289 el cual estimamos cubra hasta el mes de junio de 2021.

Government of Puerto Rico

Puerto Rico Electric Power Authority



Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES
Submittal to COR3 and FEMA



***Procurement of Water Heater 5
(Deaerator) Spare Pump
Costa Sur Power Plant***

2/1/2022



Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

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- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes
v.1	2/1/2022	



Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	Procurement of Water Heater 5 (Deaerator) Spare Pump - Costa Sur Power Plant
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number (Formerly Project Worksheet)	136271 - MEPA078 PREPA Island Wide FAAS Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: <Name>

<Insert title here>

PREPA Project Sponsor: <Name >

<Insert title here>



Section 2. Facilities

2.1. Facilities List

Name	GPS Location
Costa Sur Power Plant Procurement of Water Heater 5 (Deaerator) Spare Pump	[REDACTED] [REDACTED] [REDACTED] [REDACTED]

Note: GPS coordinates are required for all facilities.

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

In a Rankine Thermodynamic Cycle, the deaerator is the equipment where the dissolved oxygen of the feed water is removed to avoid corrosion into de boiler tubes. This open feed water heater is also the storage tank for the boiler water feed pump which pumps the water at 4000 psig to the boiler. The deaerator pump is the auxiliary equipment which pump the feed water to this open heat exchanger. It delivers water at 350 psig to keep a proper level in the deaerator for a continuous operation of the system.

Each unit (5 & 6) of South Coast steam plant has two deaerator pumps and are both necessary for full load operation (410MW). Those pumps are inspected according to the preventive maintenance schedule, but it is necessary to have a spare pump and motor since this equipment is the original one and has more than 50 years of use.

Emphasizing in this issue, an overhaul was performed in one of the pumps in unit 6 and the casing of the pump was found in bad conditions so a mayor repair will be required. To avoid risks of unit limitations or forced outages a spare deaerator pump is required. With the pump



available, a maintenance program can be initiated to refurbish all the pumps without any unit limitations or derating.

Section 3. Scope of Work

3.1. Scope of Work Description

The scope of work for the Procurement of Water Heater 5 (Deaerator) Spare Pump is to purchase and install one spare deaerator pump for both units 5 & 6.

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards:** Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project:** Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
 - a. Other improvements, not required by codes and standards
 - b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate)

If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.

Restores to Codes/Standards

Note: If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.

3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?



4.1. Codes, Specifications, and Standards

Yes/No. If yes, describe how incorporated below.

- (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE)
- (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE)
- Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730-B2 - U.S. Department of Agriculture Rural Electric Service (RUS)
- International Building Code (IBC) - International Code Council (ICC)
- International Energy Conservation Code (IECC) - International Code Council (ICC)
- International Existing Building Code (IEBC) - International Code Council (ICC)
- National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers
- National Electrical Code (NEC) - National Fire Protection Association (NFPA)
- FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.

- 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA)
- 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA)
- ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE)
- International Building Code (IBC) - International Code Council (ICC)
- Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA)
- Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA)
- RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS)
- Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.

Cost Type	Amount (\$M)
Equipment	\$400,000.00
Total Project Estimated Cost	\$400,000.00



Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: If available, detailed engineering cost estimates will be included as an attachment.

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

Program Manager's Printed Name

Date

Title

Signature

Section 9. PREPA Project Sponsor Comments

Comments
<Insert any comments here>

PREPA Project Sponsor's Printed Name

Date



Title

Signature

Section 10. Attachments

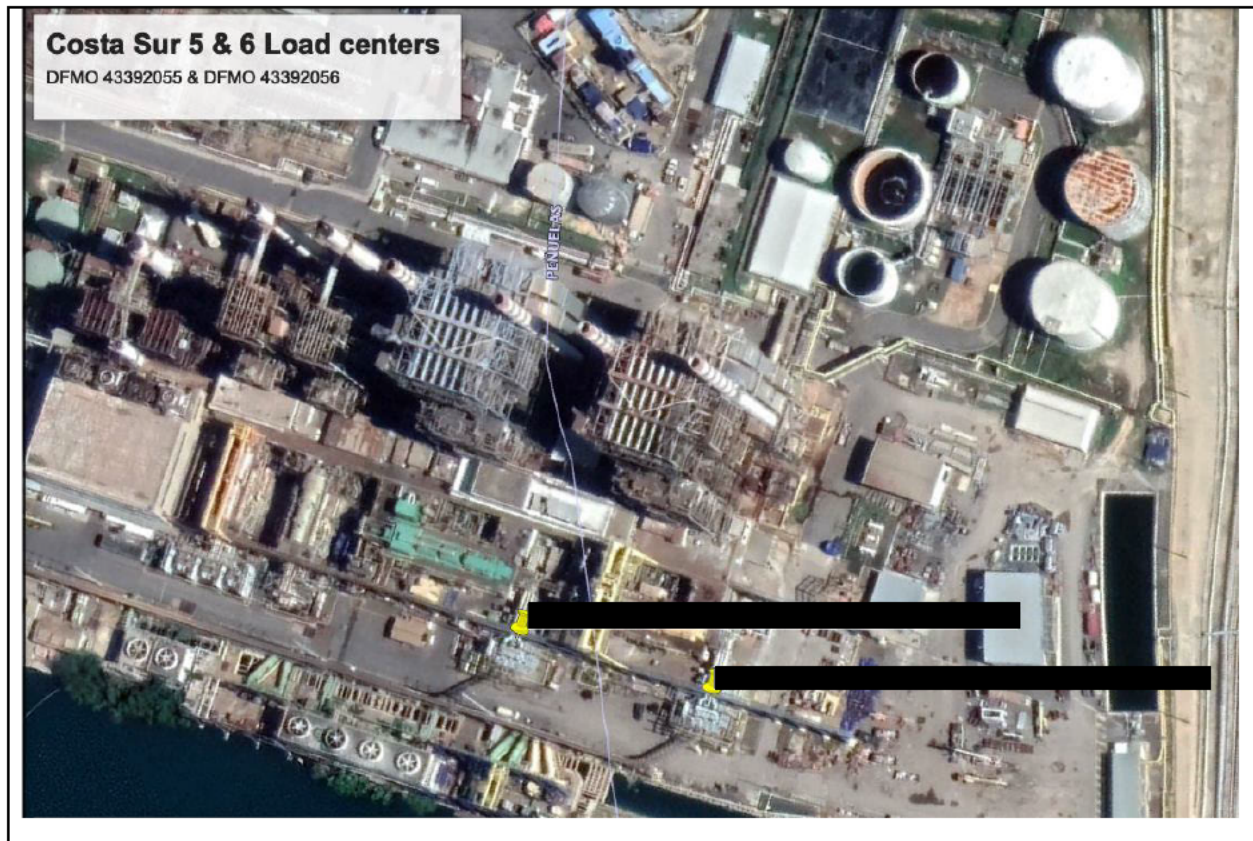
10.1. Project Detailed Cost Estimates

- Please see attached Technical specifications included in RFP 00002075 and PREPAs Fund certifications

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures



10.4. Other: (Please Describe)

N/A



GOVERNMENT OF PUERTO RICO
PUERTO RICO ELECTRIC POWER AUTHORITY

Project number: 49

Project name: Procurement of Water heater 5 (Deaerator) spare pump

Estimated cost: \$400,000

Scope of work

In a Rankine Thermodynamic Cycle, the deaerator is the equipment where the dissolved oxygen of the feed water is removed to avoid corrosion into de boiler tubes. This open feed water heater is also the storage tank for the boiler water feed pump which pumps the water at 4000 psig to the boiler. The deaerator pump is the auxiliary equipment which pump the feed water to this open heat exchanger. It delivers water at 350 psig to keep a proper level in the deaerator for a continuous operation of the system. Each unit (5 & 6) of South Coast steam plant have two deaerator pumps and both are necessary for full load operation (410MW). Those pumps are inspected according to the preventive maintenance schedule, but it is necessary to have a spare pump and motor since these equipment is the original one and have more than 50 years of use. Emphasizing in this issue, an overhaul was performed in one of the pumps in unit 6 and the casing of the pump was found in bad conditions so a mayor repair will be required. To avoid risks of unit limitations or forced outages a spare deaerator pump is required. With the pump available, a maintenance program can be initiated to refurbish all the pumps without any unit limitations or derating. The scope of this project is to purchase and install one spare deaerator pump for both units 5 & 6.



PO Box 364267 San Juan, Puerto Rico 00936-4267

"We are an equal opportunity employer and do not discriminate on the basis of race, color, gender, age, national or social origin, social status, political ideas or affiliation, religion; for being or perceived to be a victim of domestic violence, sexual aggression or harassment, regardless of marital status, sexual orientation, gender identity or immigration status; for physical or mental disability, for veteran status or genetic information."

REQUEST FOR PROPOSAL

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PUERTO RICO ELECTRIC POWER AUTHORITY

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Due Time: AST
Printed : 03/06/2019
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Return RFP to:

Vendor:

MARIO MIRANDA-SANCHEZ

BULLETIN BOARD
DIVISION DE SUMINISTROS
SAN JUAN PR 00936

M-MIRANDA-DSAD@PREPA.COM

Phone: 787-521-3301

Fax : 787-521-3298

Work Location:

CENTRAL COSTA SUR

CARR. NUM. 127, KM 15.7

GUAYANILLA PR 00656

Start Date: 04/30/2019

End Date :

Title: MANUFACTURA BOMBA DEAERATOR U5-6 COSTA SUR

*** DRAFT COPY ***

Bid Value:

Currency: USD

Not to Exceed?

Bid Pricing Method:

Bid Expiration Date:

ESTIMATE

Vendor Authorized Signature

Printed Name/Title

Date Signed

Phone

MARIO MIRANDA-SANCHEZ
Supervisor de Compras Principal
Authorized Signature

Printed Name/Title

Date Signed

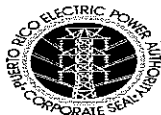
Phone

Terms and Conditions - Text at End

Fac	Standard	Rev	S/P	Text	Title
	PH000005	024	S	Y	DOCUMENTOS Y REQUISITOS GENERALES PARA PUBLICACION
	PH000006	016	S	Y	CLAUSULAS PARA PAGOS DE IMPUESTOS ESTATALES Y FEDE
	PH000009	019	S	Y	INSTRUCCIONES PARA SUBASTAS FORMALES

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Scope of Work and Terms & Conditions Text follow as attachments

SUBASTA RFP 2075

LA SUBASTA TENDRA APERTURA EL:

DIA: MIERCOLES, 20 DE MARZO DE 2019

HORA: 9:30 A.M.

LUGAR: DEPT. DE COMPRAS, EDIF. NEOS, TERCER PISO, SANTURCE

PUEDEN ENTREGAR SU COTIZACION EN LA OFICINA 306, EDIF. NEOS, SANTURCE.

LAS COTIZACION A ENTREGAR DEBE SER UN ORIGINAL Y DOS COPIAS.

NOTA ESPECIALES :

1-SE INCLUYEN ESPECIFICACIONES TECNICAS, TERMINOS CONDICIONES, ETC.

2-PARA ESTA SUBASTA LA AUTORIDAD NO ACEPTA COTIZACIONES ENVIADAS VIA FAX O CUALQUIER MEDIO ELECTRONICO.

3-LUEGO DE LA APERTURA DE LA SUBASTA, LOS LICITADORES, SUS REPRESENTANTES Y OTRAS PARTES NO PUEDEN COMUNICARSE EN FORMA ALGUNA CON EMPLEADOS DE LA AUTORIDAD DE ENERGIA ELECTRICA PARA ASUNTOS RELACIONADOS CON LAS PROPUESTAS BAJO ESTUDIO, SALVO LO DISPUESTO POR LEY NÚM. 170, DEL 12 DE AGOSTO DE 1988, SEGUN ENMENDADA Y LA REGLAMENTACION PROMULGADA A SU AMPARO. REGLAMENTO DE SUBASTAS, CAPITULO II, SECCION 8, ARTICULO C, INCISO 2.

RE: CONTRATO PARA LOS SERVICIOS DE RENTA, INSTALACION Y DESINSTALACION DE ANDAMIOS DE FACIL ENSAMBLAJE PARA REPARACIONES DE CALDERAS Y RECUPERADORES DE CALOR EN LAS CENTRALES GENERATRICES DE LA AUTORIDAD DE ENERGIA ELECTRICA

4-EL LICITADOR AGRACIADO TIENE QUE SOMETER FIANZA DE EJECUCION DEL 20 POR CIENTO.

5-LA FIANZA (BID BOND) DEL 10 POR CIENTO PUEDE SER DEL ANNUAL BID BOND

REQUISITOS Y DOCUMENTOS GENERALES:

1. TODO PROVEEDOR QUE INTERESE PARTICIPAR EN LOS PROCESOS DE COMPRAS EN LA AUTORIDAD DE ENERGÍA ELÉCTRICA, TIENE QUE PERTENECER AL REGISTRO DE PROVEEDORES DE LA AUTORIDAD DE ENERGÍA ELÉCTRICA.

2. LOS LICITADORES TIENEN QUE INCLUIR CON SU COTIZACIÓN UNA DECLARACIÓN JURADA DE NO CONFLICTO DE INTERESES O COPIA CERTIFICADA DE LA DECLARACIÓN JURADA DE NO CONFLICTO DE INTERESES VIGENTE EN EL REGISTRO DE PROVEEDORES DE LA AUTORIDAD DE ENERGÍA ELÉCTRICA.

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1. BIDDERS WHO INTEND TO PARTICIPATE IN PREPA'S PURCHASING PROCESSES MUST BE REGISTERED IN THE PUERTO RICO ELECTRIC POWER AUTHORITY'S BIDDER'S REGISTRY.

2. BIDDERS SHALL INCLUDE PREPA'S SWORN STATEMENT OF "NON-CONFLICT OF INTERESTS" WITH PROPOSAL DOCUMENTS OR A CERTIFIED COPY OF THE CURRENT SWORN STATEMENT PREVIOUSLY SUBMITTED ON THE BIDDER'S REGISTRY OFFICE.

CLÁUSULAS PARA PAGOS DE IMPUESTOS ESTATALES Y FEDERALES

EN CUMPLIMIENTO CON LA SECCIÓN 2906 DEL ARTÍCULO 2, DEL CÓDIGO DE RENTAS INTERNAS DE PUERTO RICO, LA AUTORIDAD DE ENERGÍA ELÉCTRICA ESTÁ EXENTA DEL PAGO DEL ARBITRIO GENERAL DEL 6.6%. ADEMÁS, A PARTIR DEL 15 DE NOVIEMBRE DE 2006, ESTÁ EXENTA DEL PAGO DEL IMPUESTO A LA VENTA Y USOS (IVU) ESTATAL Y MUNICIPAL POR VIRTUD DE LA SECCIÓN 2508 DE LA LEY 117 DEL 4 DE JULIO DE 2006, CONOCIDA COMO LA LEY DE JUSTICIA CONTRIBUTIVA.

* LAS FACTURAS TIENEN QUE DETALLAR EL CONCEPTO DE LA COMPRA O SERVICIO.

LOCAL AND FEDERAL TAXES CLAUSE

IN COMPLIANCE WITH PUERTO RICO'S INTERNAL REVENUE SERVICE CODE, SECTION 2906, ARTICLE 2, PUERTO RICO ELECTRIC POWER AUTHORITY IS EXEMPT OF 6.6% TAX PAYMENT, ALSO, STARTING ON NOVEMBER 15TH, 2006; AND IN ACCORDANCE TO LAW 117 OF 4TH OF JULY OF 2006, KNOWN AS "LEY DE JUSTICIA CONTRIBUTIVA"; PREPA IS EXEMPT OF "IVU (IMPUESTO A LA VENTA Y USOS ESTATAL Y MUNICIPAL)" TAX PAYMENT.

INVOICES SHALL INCLUDE ALL DETAILS RELATED TO GOOD OR SERVICE PURCHASED.

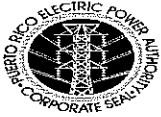
INSTRUCCIONES PARA PARTICIPAR EN SUBASTA FORMAL

1. SE INCLUYEN INSTRUCCIONES ESPECIALES PARA ESTA INVITACIÓN A SUBASTA FORMAL, ASÍ COMO LOS DOCUMENTOS QUE EN ELLA SE MENCIONAN.

2. LOS LICITADORES QUE INCLUYAN EN LA COTIZACIÓN TÉRMINOS Y CONDICIONES DE VENTA O SERVICIO DIFERENTES A LOS ESTABLECIDOS EN LOS DOCUMENTOS DE TÉRMINOS, CONDICIONES Y ESPECIFICACIONES ESTABLECIDOS

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PARA ESTA SUBASTA PODRÁN SER DECLARADOS NO RESPONDIENTE.

3. GARANTÍA DE LA PROPUESTA- PARA ESTA SUBASTA SE REQUIERE UNA GARANTÍA DE LICITACIÓN (BID BOND) O SU EQUIVALENTE PARA GARANTIZAR EL 10 PORCIENTO DEL TOTAL DE LA PROPUESTA A PRESENTARSE. LAS PROPUESTAS QUE NO INCLUYAN ESTA GARANTÍA SERÁN RECHAZADAS.

4. PARA ESTA SUBASTA LA AUTORIDAD DE ENERGÍA ELÉCTRICA NO ACEPTARÁ PROPUESTAS POR FACCIÓN O MEDIOS ELECTRÓNICOS.

5. ES RESPONSABILIDAD DEL LICITADOR TENER DISPONIBLE UNA CERTIFICACIÓN DEL DEPARTAMENTO DE HACIENDA DONDE ESTABLEZCA SU ESTATUS SOBRE EL PAGO DE CONTRIBUCIONES O PARA LOS CASOS DE DEUDAS PENDIENTES, SI POSEE ALGÚN PLAN DE PAGO; ESTO EN CASO DE ASÍ REQUERIRSE.

THE FOLLOWING CONDITIONS, TECHNICAL SPECIFICATIONS & DRAWINGS ARE THE REQUIREMENTS FOR MANUFACTURE AND DELIVERY A DEAERATOR & MOTOR PUMP "AS IS" FOR UNITS 5-6 AT SOUTH COAST STEAM PLANT IN GUAYANILLA, P.R.

A. MOTOR SPECIFICATIONS:

- MANUFACTURER – GE
- MODEL - 5K830952C9
- RATED HORSE POWER – 1250 HP
- DRAWING NUMBER – 34C104561
- VOLTS – 4000
- FULL LOAD AMPERES – 162 A
- LOCKED ROTOR AMPERES – 972 A
- FULL LOAD SPEED – 1785 RPM
- FRAME – 8309S
- PHASE – 3
- TYPE – K
- CYCLES – 60 HZ
- SERVICE FACTOR – 1
- STARTING & FULL LOAD TORQUE – 3676 FT-LB
- POLES – 4
- NET WEIGHT – 5000 LBS APROX.
- EFFICIENCY – FULL 94.1, $\frac{3}{4}$ 94.1, $\frac{1}{2}$ 93.5
- POWER FACTOR – FULL 88, $\frac{3}{4}$ 86, $\frac{1}{2}$ 80
- DUTY- CONTINUOUS
- TEMPERATURE RISE – 90 C
- INSULATION CLASS - B
- CODE – F
- COOLING TYPE – FORCED AIR
- MOTOR ROTOR BARS NUMBER - 58
- MOTOR STATOR SLOT NUMBER - 72
- TYPE OF BEARINGS – SPLIT SLEEVE
- MOTOR LUBRICATION TYPE - MOBIL DTE HEAVY MED
- SPACE HEATERS – 115 V, 800 WATTS
- MAIN CONDUIT BOX ENTRANCE OPENING – 4 INCH NPT
- AUX. CONDUIT BOX ENTRANCE OPENING – 2 HOLES, EACH 1 INCH NPT
- TERMINAL BOX LOCATION –RIGHT LOOKING AT END OPPOSITE SHAFT END

B. PUMP SPECIFICATIONS:

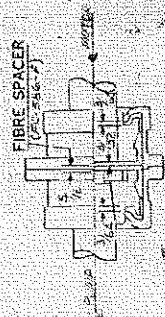
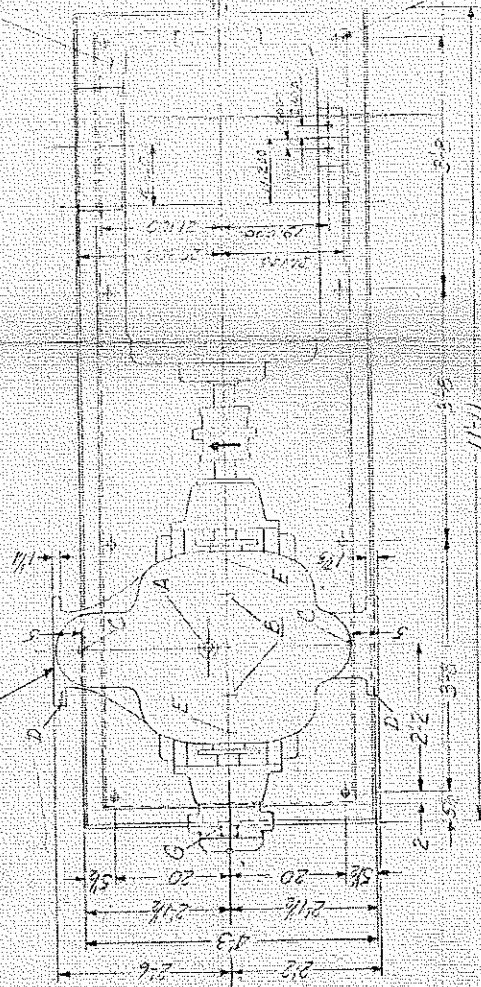
- MANUFACTURER – DE LAVAL TURBINE INC
- MODEL – P DOUBLE SUCTION
- TYPE – 1250M P 12/10 D
- CAPACITY - 5500 GPM
- BRAKE HORSE POWER – 1185 HP
- IMPELLER QUANTITY – 1
- IMPELLER DIAMETER – 26-5/8 INCH
- TOTAL HEAD - 700
- COOLING TYPE – WATER
- PUMP NO. OF STAGES - 1
- VANES PER STAGE – 5
- PUMP LUBRICATION TYPE - MOBIL DTE HEAVY MED

C. OTHER TERMS & CONDITIONS:

- 1- REQUIRED DELIVERY TIME FOR THE EQUIPMENT IS FORTY (40) CONSECUTIVE WEEKS AFTER DRAWINGS APPROVAL. QUOTATIONS EXCEEDING THE MAXIMUM DELIVERY TIME AS STATED ABOVE WILL BE REJECTED.
- 2- AFTER ORDER AWARD, THE CONTRACTOR SHALL SUPPLY TO PREPA WITHIN TWENTY (20) CONSECUTIVE DAYS ALL DIAGRAMS AND/OR DRAWINGS FOR A WRITTEN APPROVAL FROM PREPA TO START THE MANUFACTURE OF THE EQUIPMENT.
- 3- DRAWINGS SHALL BE WRITTEN APPROVED BY PREPA REPRESENTATIVE FOR THE COMMENCEMENT OF THE EQUIPMENT MANUFACTURE WITHIN TEN (10) CONSECUTIVE DAYS AFTER RECEIVED FROM THE CONTRACTOR.
- 4- IF DRAWINGS ARE NOT APPROVED BY PREPA, BECAUSE THEY DO NOT COMPLY WITH PREPA REQUIREMENTS, THE CONTRACTOR SHALL HAVE FIFTEEN (15) ADDITIONAL CONSECUTIVE DAYS TO SUBMIT THE NEW DRAWINGS AND THESE DAYS WILL BE SUBTRACTED FROM THE REQUIRED DELIVERY TIME ESTABLISHED ON ITEM #1.
- 5- IF DRAWINGS OR DIAGRAMS SUBMITTED TO PREPA COMPLIES WITH PREPA REQUIREMENTS AND THEY ARE NOT APPROVED BECAUSE OF PREPA'S SPECIAL INTEREST OR REASONS, THEN AN EQUIVALENT TIME EXTENSION WILL BE GRANTED FOR THIS PERIOD OF TIME.
- 6- THE EQUIPMENT SHALL BE DELIVERED TO SOUTH COAST STEAM PLANT IN GUAYANILLA, P.R.
- 7- REQUIRED MANUALS: ONE (1) ELECTRONIC MANUAL (PDF) THAT INCLUDES THE FOLLOWING:
 - A. GUIDELINE FOR INSPECTION, TESTING AND MAINTENANCE WITH LUBRICATION SCHEDULE
 - B. ELECTRICAL BILLS OF MATERIALS AND ELECTRICAL SCHEMATICS
 - C. MECHANICAL ASSEMBLY DRAWINGS
- 8- WARRANTY REQUIRED: FREE FROM DEFECTS IN MATERIAL AND WORKMANSHIP FOR 12 MONTHS FROM DATE OF INSTALLED ON SIDE OR TWO THOUSAND (2000) HOURS OF OPERATION, WHICHEVER EXPIRES FIRST.
- 9- THE NEW PUMP&MOTOR WILL BE USED AS A SUBSTITUTE TO EXISTING EQUIPMENT OF THE SAME CAPACITY AT SOUTH COAST PLANT UNITS 5 AND 6. THE NEW EQUIPMENT SHALL BE DESIGNED TO FIT IN THE EXISTING BASES WITHOUT MODIFICATIONS TO THE EXISTING DISCHARGE AND SUCTION PIPES.
- 10- THE EQUIPMENT AND ALL OF ITS COMPONENTS AND PARTS SHALL BE CAPABLE TO OPERATE AT HIGH TEMPERATURES OR OTHER SEVERE CONDITIONS, AND THEY SHALL BE CONSTRUCTED WITH THE BEST AVAILABLE MATERIALS ADEQUATE FOR THE REQUIRED SERVICE. **TOXIC OR OTHER HAZARDOUS MATERIALS, PARTS OR PAINTS SHALL NOT BE USED.** PREPA MAY REQUIRE, AT ANY MOMENT, THE MATERIALS SAFETY DATA SHEET OF ANY PRODUCT USED IN THE MANUFACTURING OF THIS EQUIPMENT.
- 11- THE EQUIPMENT AND ALL OF ITS COMPONENTS AND PARTS SHALL BE CAPABLE TO OPERATE AT HIGHTEMPERATURES OR OTHER SEVERE CONDITIONS, AND THEY SHALL BE CONSTRUCTED WITH THE BEST AVAILABLE MATERIALS ADEQUATE FOR THE REQUIRED SERVICE. **TOXIC OR OTHER HAZARDOUS MATERIALS, PARTS OR PAINTS SHALL NOT BE USED.** PREPA MAY REQUIRE, AT ANY MOMENT, THE MATERIALS SAFETY DATA SHEET OF ANY PRODUCT USED IN THE MANUFACTURING OF THIS EQUIPMENT.

- 12- THREADED HOLES TO ATTACH EYE BOLTS OF STANDARD SIZE IN THE ENGLISH SYSTEM AND OF COMMON USE, SHALL BE PROVIDED ON THE EXTERNAL FRAME OF THE PUMP&MOTOR TO ALLOW THE LIFTING OF THE EQUIPMENT IN A SAFE MANNER INCLUDING THE HEAVIEST COMPONENTS.
- 13- INSULATING MATERIALS USED IN MOTORS CONSTRUCTION SHALL BE OF THE BEST QUALITY AVAILABLE AND SHALL COMPLY WITH THE LATEST ANSI, NEMA, IEEE STANDARDS, AND THE ELECTRIC APPARATUS SERVICE ASSOCIATION (EASA). **THE USE OF ASBESTOS MATERIAL IS TOTALLY PROHIBITED.**
- 14- THE CONNECTION BOXES FOR THE POWER LEADS, RTD'S, THERMOCOUPLES AND HEATERS SHALL BE OF APPROPRIATE DIMENSIONS AND WITH ENOUGH SPACE TO ALLOW THE CONNECTION AND DISCONNECTION EASILY. THE CONNECTION BOXES SHALL BE LOCATED IN ACCORDANCE WITH THE EXISTING MOTOR BOXES LOCATION OR AS PER SUPPLIED DIAGRAM BY PREPA IF A WRITTEN REQUIREMENT IS MADE BY THE BIDDER OR SUPPLIER.
- 15- ALL THE EXTERNAL COMPONENTS EXPOSED TO THE AMBIENT OR SUBJECT TO HEATING BEING FABRICATED FROM CAST IRON, IRON, STEEL OR CARBON STEEL SHALL BE PAINTED IN FACTORY WITH AT LEAST TWO LAYERS OF THE BEST QUALITY PAINT IN THE MARKET AND SHALL BE HEAT, OIL AND DIRT RESISTANT. THEY SHALL RESIST AMBIENT EFFECTS AS THEY APPLY IN ACCORDANCE WITH THE BEST INDUSTRY PRACTICES ON THE EQUIPMENT MANUFACTURER. ALL THE OTHER COMPONENTS AND PARTS MADE IN IRON, STEEL OR STEEL ALLOYS, NOT EXPOSED TO THE AMBIENT OR SUBJECT TO HIGH TEMPERATURES, SHALL BE FINISHED IN FACTORY WITH AT LEAST ONE PRIMING COAT PLUS A SECOND EXTERNAL COAT IN ORDER TO OBTAIN MINIMUM THICKNESS OF 4.5 MILS. THE PRIMER SHOULD BE A RED IRON OXIDE ZINC CHROMATE ALKYD OF .75 TO 1 MIL ADEQUATE TO PROTECT EQUIPMENT AGAINST CORROSION IN THE CONDITIONS AND LOCATION OF THE EQUIPMENT IN A TROPICAL ZONE. THE OUTER PAINT LAYERS SHALL BE AS PER MANUFACTURER STANDARD COLOR OR AS PER INSTRUCTIONS SUPPLIED BY PREPA THROUGH ITS REPRESENTATIVE. MOTORS EXTERNAL FRAME AND PARTS SHALL BE COMPLETELY PAINTED. **NO LEAD-BASED PAINTS SHALL BE USED.**
- 16- THE MANUFACTURER SHALL MAKE ALL NECESSARY TESTS TO ENSURE HIS MATERIAL AND WORKMANSHIP ARE OF THE REQUIRED DEGREE OF EXCELLENCE AND THAT THE EQUIPMENT FURNISHED BY HIM SHALL PERFORM AS SPECIFIED AND GUARANTEED. ALL TESTS SHALL BE CONDUCTED IN ACCORDANCE WITH THE LATEST APPLICABLE TESTS CODES FOR THIS TYPE OF EQUIPMENT FROM THE NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION, THE AMERICAN NATIONAL STANDARD INSTITUTE, THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS AND OTHER RELATED ORGANIZATIONS. THE MANUFACTURER SHALL PROVIDE TO PREPA ALL DATA OBTAINED FROM THE EQUIPMENT TESTS AS REQUIRED. THE OBTAINED VALUES SHALL BE TABULATED IN EACH AND EVERY ONE OF THE TESTS AND WRITTEN CERTIFIED INCLUDING THE GRAPHS AND CURVES OBTAINED.

SUCTION 12-125 ASA DRILL 1/2
17-02, 12-125A HOLE ON 17-BA EC,
EYES OFF HOLE STRAIGHT



2 COUPLING DETAIL
LIMITED END FLOAT TYPE

W. HEIGHT 5'11" 1/2
W. WT 150 LBS
DOB 12/10/00
AGE 19
DATE 11/20/00
W. WT 150 LBS
Type 12024 P/12/100
12040 - 1705.000

TO AVOID POSSIBLE LEAKAGE OF THE FLANGES WHEN
TIGHTENING UP THE JOINTS, WE RECOMMEND STRONGLY
AGAINST THE USE OF RAISED FACE FLANGES. LEAKAGE
CAN ONLY BE AVOIDED BY USING EXTREME CARE IN
TIGHTENING UP THE ROLLS.

[illegible]

Total Hand 100
 SPIN - 3,500
 Type Found 4, 10/10

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10-250-254 DATE 11/16/72
17 1/2 Q.D. 16-DIG HOLE ON 15th
40-55 STATION 16

TEST RESULTS OF

PUERTO RICO WATER RESOURCES AUTHORITY

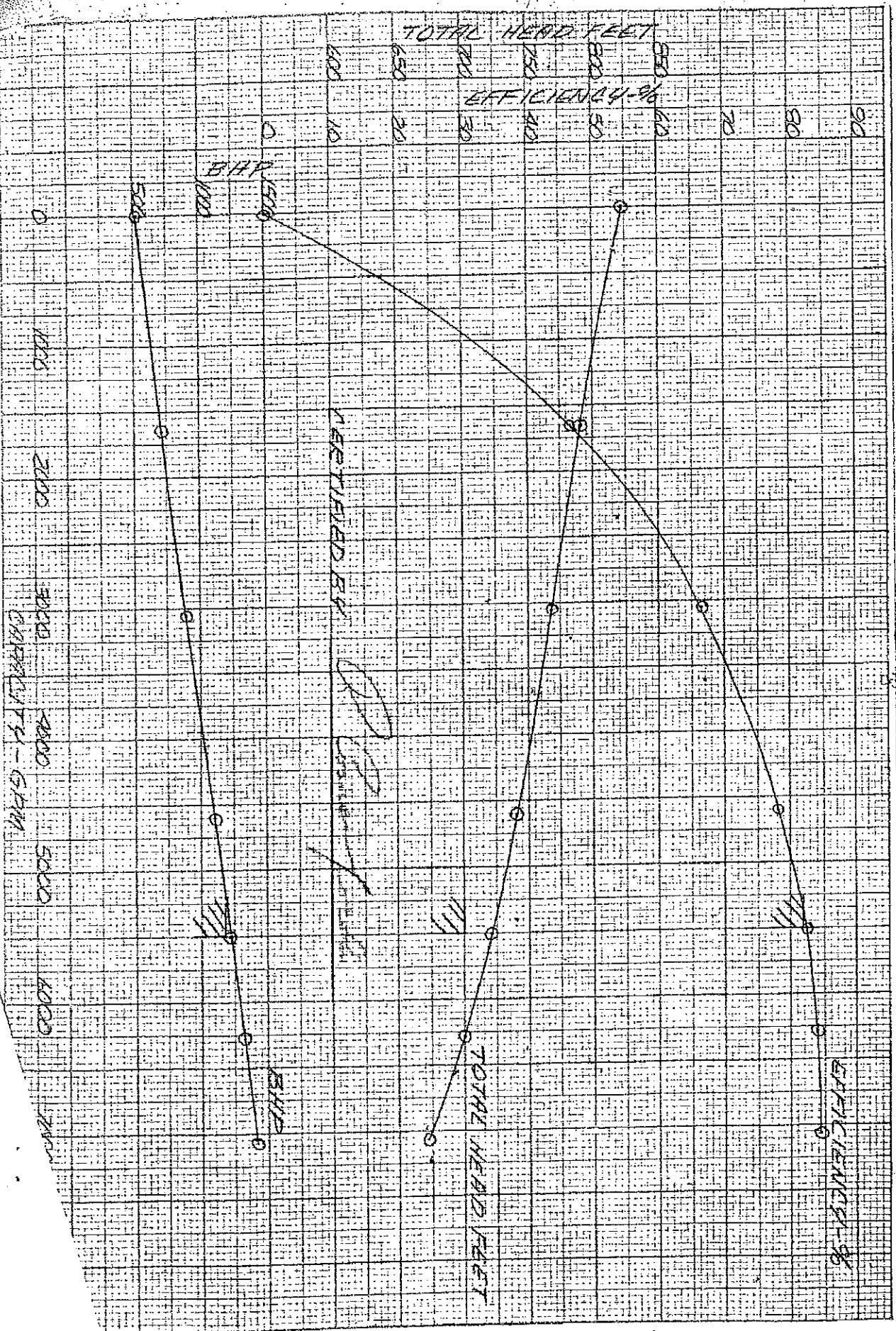
ORDER NO. 705038

5000 546
Decatur Humps

55/50

741-1095 @ 26.5 RPM

TYPE P12/10 D
SPEED 1785
FIELD 10.7516
SUCTION
DATE 7/30/20



TEST RECORD OF CENTRIFUGAL PUMP PERFORMANCE

DE LAVAL TURBINE INC.

DATE 7/30/70

No. 676 (8-2) 10/66

SUBJECT

Puerto Rico Water Resources Authority

TEST NO.

ORDER NO.

705038

DESIGN CONDITIONS

TOTAL HEAD	CAPACITY	BPM	EFFICIENCY	SPEC. GRAVITY	IMPELLER SYMBOL	DIAMETER	SPEED
700 FT.	5500 GPM	1185	82%	.9938		10 1/2"	1785 RPM
TEMP. 115 °F	N.P.S. 20' MIN	TYPE P12/102	CASE NO. 55/5D		FW-1095	2 6 5/8"	

INPUT				SUCTION				DISCHARGE				CAPACITY				RESULTS CORRECTED			
GROSS	TARE	NET	SPEED R.P.M.	CORR. "HG.	TEMP. °F	VEL. FEET	TOTAL HEAD FEET	MAN. "HG.	GPM	BRAKE HORSE POWER	EFF. PER CENT	TOTAL GPM	BRAKE HORSE POWER	TOTAL HEAD FEET	SG	TOTAL GPM	BRAKE HORSE POWER	TOTAL HEAD FEET	SG
304	18	286	1250	480	6.6	86	172	396.8	0	403.4	0	0	1788	0	0	520.7	822.1		
407		389		505	6.8		165.1	380.9	.2	387.9	1.30	1158	243.1	46.2	1654	707.9	791.6		
508		490		585	7.7		159.6	368.2	.6	376.5	4.45	2143	306.5	66.5	3060	891.9	767.6		
623		605		750	9.6		152.6	352.0	1.3	362.6	10.05	3221	578.4	78.1	7600	1101.9	741.4		
688		670		880	11.1		147.5	340.2	2.0	353.3	14.42	3858	416.8	82.2	5509	1210.5	720.4		
745		727		1000	12.4		142.4	328.4	2.5	343.3	18.73	4397	454.4	83.9	6279	1323.2	720.4		
738		720	1200	1095	13.5		124.7	287.5	3.0	304.0	21.88	4752	432.0	84.4	7069	1421.9	672.2		

ELEVATION CORRECTION

TORSION METER

VENTURI

10A

REMARKS

Suction 41.13'

MKG.

K - VENTURI

1016

Discharge -67'

BAR

NOZZLE

Mercury Col.

DYNA. NO.

450

K - NOZZLE

MOTOR NO.

CONSTANT

2000

GAROMETER

HORSEPOWER

K - VEL. HEAD 75X10⁵

Witnessed by

Tested by

ERICK

Souco 5 & 6
Deaerator Pumps

704526

Sheet

of

Date

MOTOR DATA

G.E. REQ. 320-93556

Plant PUERTO RICO WATER RESOURCES Project No. _____

Motor Service DEAERATOR PUMP DRIVE

Manufacturer GE. Drawing No. 34C104561

Rated Horse Power 1250 Frame No. 8309S NEMA Design _____

Voltage 4000 Phase 3 Cycle 60

Full Load Amperes 162. Locked Rotor Amperes 972.

Full Load Speed (rpm) 1785. WR^2 (LB-FT squared) 405.

Starting Torque (FT-LB) 3676. Full Load Torque 3676. LB.FT.

Efficiency: Full 94.1 3/4 94.1 1/2 93.5 Loads

Power Factor: Full 88. 3/4 86. 1/2 80. Loads

Enclosure DRIPPROOF Net Weight 5000 LBS APPROX.

Temperature Rise: Deg. C Over Amb. 90 By RTD @ 1437 HP Deg. C Ambient 40

Insulation Class B CUSTOM POLYMER Stator Winding Thermal Device 10 OHM RTDS.

Type of Bearings SPLIT SLEEVE Bearing Thermocouples DUAL ELEMENT COPPER-CONSTANTAN

Rotation Looking at End Opposite Shaft End DUAL

Terminal Box Location Looking at End Opposite Shaft End: Right X Left _____

Motor Leads Connectors (Type & Mfr.) AMP #325250, COMPRESSION TYPE

Conduit Box Entrance Opening - Main Leads 4 INCH N.P.T. inches

Conduit Box Entrance Opening - Aux. Leads 2 HOLES, EACH 1" NPT inches

Space Heaters: Voltage 115 Wattage 800

Remarks:

DATA BY R. H. HAILE
2-27-70

MEMO OF
DATA TRANSMITTAL

3-26-70

(DATE)

CUSTOMER

MEDIUM A.C. MOTOR DEPARTMENT

GENERAL ELECTRIC

SCHENECTADY, N. Y. 12305

(LOCATION)

Refer to G.E. Req'n No.
in Correspondence

G.E. MAIL

(PRINTS FORWARDED VIA)

PUERTO RICO WATER RESOURCES AUTH.
FOR DE LAVAL BOILER FEED PUMPS IN SOUCO UNITS 5 AND 6, YABUCOA 1 & 2

STATION OR PROJECT NO.

CUSTOMER ORDER	CUSTOMER REQ.	G.E. CONTRACT	G.E. REQUISITION
C 08442 A 126-8	1-24-69		247-P21-806710X1

Drawings are intended to be in accordance with applicable purchase order specifications. Comments are solicited concerning any departures in this respect. Features not covered by purchase order specifications portray General Electric Company standard design practice. The shipping date for this equipment is based on obtaining approval by the above specified date, and any delay in approval may extend the shipping schedule. Any requested changes from the purchase order specifications, resulting in additional engineering and/or manufacturing costs, may entail an increase in price and the extension of the shipping schedule.

PRINTS ARE:

☐ FOR APPROVAL ☒ FOR INSTALLATION ☐ FOR REFERENCE ☐

Approval Required
Within 5 Days, OR BY.....(Date)

RETURN OF "FOR APPROVAL" PRINTS SHOULD BE ADDRESSED TO THE
GENERAL ELECTRIC OFFICE WITH WHOM YOUR ORDER IS PLACED.

—NOT TO THE FACTORY—

ITEM 1A

34D104356-001	OUTLINE
34A740445-002	SOLE PLATE
34A770200-004	MOTOR CONN.
34A472069-101	SHAFT SKETCH
34C841074-101	COND. BOX & ACCESS.
34B840383-003	HEATER CONN.

MAIL 7 PRINTS EA. TO:
H. OKAZAKI, IGE, NEW YORK OFFICE
FOR TRANSMITTAL TO CUSTOMER

NOTE:

(6) 10 OHM STATOR RTD'S IN WINDING, 2 PER PHASE.
COPPER CONSTANTAN DUAL ELEMENT THERMOCOUPLE IN EA. BRG.
BRGS. ARRANGED FOR FORCED FEED LUBRICATION. PUMP,
TANK & PIPING TO BE SUPPLIED BY OTHERS THAN G.E.

OIL REQUIREMENTS:

RATE OF FLOW= 3 G.P.M. PER MOTOR
OIL PRESSURE= 10 TO 15 P.S.I.
OIL VISCOSITY= 150 SSU AT 100°F
C.T. CURRENT RATIO= 800/5, TYPE JKM-3
LOCKED ROTOR CURRENT= 4740 AMPS
CUSTOMER'S LINE CABLE SIZE= 2-500 MCM/PHASE
WITH SCREENS

(FOR 8 MOTORS ONLY) SOLE PLATE- 34A740445-002
SHAFT SKETCH- 34A472069-101
COND. BOX & ACCESS. 34C841074-101

MOTOR MODEL - 5K851282C2
MOT. SERIAL - 8375875 - 884
APPLICATION - SEE ABOVE
ENCLOSURE - DRIPPROOF

BEARINGS - SLEEVE (SEE NOTE)
LUBRICATION - OIL (SEE NOTE)
TYPE - K
FRAME - 85122
POLES - 2
H.P. - 5000
SYN. SPEED - 3600
PHASES - 3
FREQUENCY - 60
VOLTS - 4000
CONSTRUCTION - DS22 SPECIAL
INSUL. CLASS - B CUSTOM POLYSEAL
TEMP. RISE - 90°C BY RTD @ 5750 HP
ROT.(O.P.E.) - CLOCKWISE
F.L. SPEED - 3570
F.L. AMP. - 632
CODE - H
AIR GAP - .180
END PLAY - 1/2"
NET WEIGHT - 60,000# APPROX. (FOR SET
MOTOR TERM - G.E. STD.
LINE TERM -
HEATER WATTS - 1600
HEATER VOLTS - 115
INSTR. BOOK - GEH-3185
OUTLINE - 34D104356-001 (SET OUT.)
MOTOR CONN. - 34A770200-004
HEATER CONN. - 34B840383-003

B DESJARDINS, BLDG. #40-5
RH HAILE, BLDG. #40-5

Copy of M/S to ↑

ENGINEERING REQUISITION SERVICE

By A.J. GUERRA

LA-403-A (4-69)

PRINTS ARE NOT TO SCALE, are loaned subject to return
upon demand, and the express condition that they will not be
used in any way detrimental to the General Electric Company.

TITLE (OUTLINE)
INDUCTION MOTOR
FIRST MADE FOR DL-5K8309.52C9

[illegible]

REVISIONS	PRINTS TO
1	1

Suggested Sites Web Slice Gallery

Asset Suite TIMNC10 - REQUEST FOR PROPOSAL PRINT

☒ Print job launch successful.

Number	00002075	Draft	<input checked="" type="checkbox"/>
Due Date	03/20/2019		
Printer ID	LOCAL	Attachment	TEXT
Status	PENDING		

Print

Print Preview

<input type="checkbox"/>	Vendor	Location	PS	Bid Status	Vendor Name
<input type="checkbox"/>	000228	01	<input type="checkbox"/>	PENDING	CAMFER ENG SERVICES INC
<input type="checkbox"/>	000480	01	<input type="checkbox"/>	PENDING	ENGINEERED PARTS SERVICES
<input type="checkbox"/>	001026	01	<input type="checkbox"/>	PENDING	POWER EQUIPMENT INC PR
<input type="checkbox"/>	001505	01	<input type="checkbox"/>	PENDING	R G ENGINEERING INC
<input type="checkbox"/>	00540202	01	<input type="checkbox"/>	PENDING	BULLETIN BOARD
<input type="checkbox"/>	018084	01	<input type="checkbox"/>	PENDING	ALLIED POWER TECHNOLOGIES
<input type="checkbox"/>	104920	01	<input type="checkbox"/>	PENDING	AP EQUIPMENT INC

Government of Puerto Rico

Puerto Rico Electric Power Authority



Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES
Submittal to COR3 and FEMA



Costa Sur Power Plant

***Procurement of Induced Draft Fan (IDF) and Forced
Draft Fan (FDF) Spare Motors for Units 5 and 6***

11/29/2021



Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes



Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	Procurement of Induced Draft Fan (IDF) and Forced Draft Fan (FDF) Spare Motors for Units 5 and 6
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number (Formerly Project Worksheet)	136271 - MEPA078 PREPA Island Wide FAASt Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: <Name>

<Insert title here>

PREPA Project Sponsor: <Name >

<Insert title here>



Section 2. Facilities

2.1. Facilities List

Name	GPS Location
<i>Costa Sur 5 IDF & FDF</i>	██████████
<i>Costa Sur 6 IDF & FDF</i>	██████████

Note: GPS coordinates are required for all facilities.

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

Each boiler of Costa Sur has a set of forced draft fans and induced draft fans. The forced draft fan controls the airflow entering the Boiler. This fan along with the forced draft fan maintain a negative pressure inside the boiler to control the combustion that generates the heat to produce steam. This guarantees the reliability of the operation of the Boilers to changes in the load of the Electric System.

The four (4) forced draft fan motors installed in the Boilers have been in service for 42 years. When one of these motors breaks down, the Boiler is limited to half capacity while the damaged motor is repaired. The repair time of an engine can take more than a month of work in a repair shop in Puerto Rico.

For this reason we must keep a spare engine, which is why the request for this purchase is justified.



Section 3. Scope of Work

3.1. Scope of Work Description

In a boiler, the Force Draft Fan (FDF) is the auxiliary equipment that delivers air to the furnace for the combustion process. In the other hand, the Induced Draft Fan (IDF) retrieves the flue gases from the furnace, keeping the furnace at a negative pressure to avoid flue gas leakage through the enclosure and ports. Two FDFs and two IDFs are required for a full load operation. The loss of any of them redounds in a unit limitation of 50% of the load. Since there is not a suitable spare motor for those Fans and considering the extensive downtime period to refurbish a damaged motor (over three months) it is cost effective to purchase a spare motor for each fan. Thus, the scope of this project is to purchase two motors: one for the IDF (4500hp) and one for the FDF (1750hp).

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards:** Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project:** Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
 - a. Other improvements, not required by codes and standards
 - b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate)
<i>If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.</i>
Restores to Codes/Standards

Note: If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.

3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.



Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?

4.1. Codes, Specifications, and Standards

Yes/No. If yes, describe how incorporated below.
<ul style="list-style-type: none"> • (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE) • (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE) • Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730-B2 - U.S. Department of Agriculture Rural Electric Service (RUS) • International Building Code (IBC) - International Code Council (ICC) • International Energy Conservation Code (IECC) - International Code Council (ICC) • International Existing Building Code (IEBC) - International Code Council (ICC) • National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers • National Electrical Code (NEC) - National Fire Protection Association (NFPA) • FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.
<ul style="list-style-type: none"> • 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA) • 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA) • ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE) • International Building Code (IBC) - International Code Council (ICC) • Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA) • Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA) • RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS) • Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.



Cost Type	Amount (\$M)
Manufacture and Delivery: 4500 HP HORIZONTAL MOTOR FOR INDUCED DRAFT FANS (IDF) UNITS 5 AND 6 OF COSTA SUR (CR 252640)	\$715,000.00
Manufacture and Delivery: 1750 HP HORIZONTAL MOTOR FOR FORCED DRAFT FANS (FDF) UNITS 5 AND 6 OF COSTA SUR (CR 252642)	\$445,000.00
Total Project Estimated Cost	\$ 1,160,000.00

Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: If available, detailed engineering cost estimates will be included as an attachment.

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

Program Manager's Printed Name

Date

Title

Signature

Section 9. PREPA Project Sponsor Comments

Comments



<Insert any comments here>

PREPA Project Sponsor's Printed Name

Date

Title

Signature

Section 10. Attachments

10.1. Project Detailed Cost Estimates

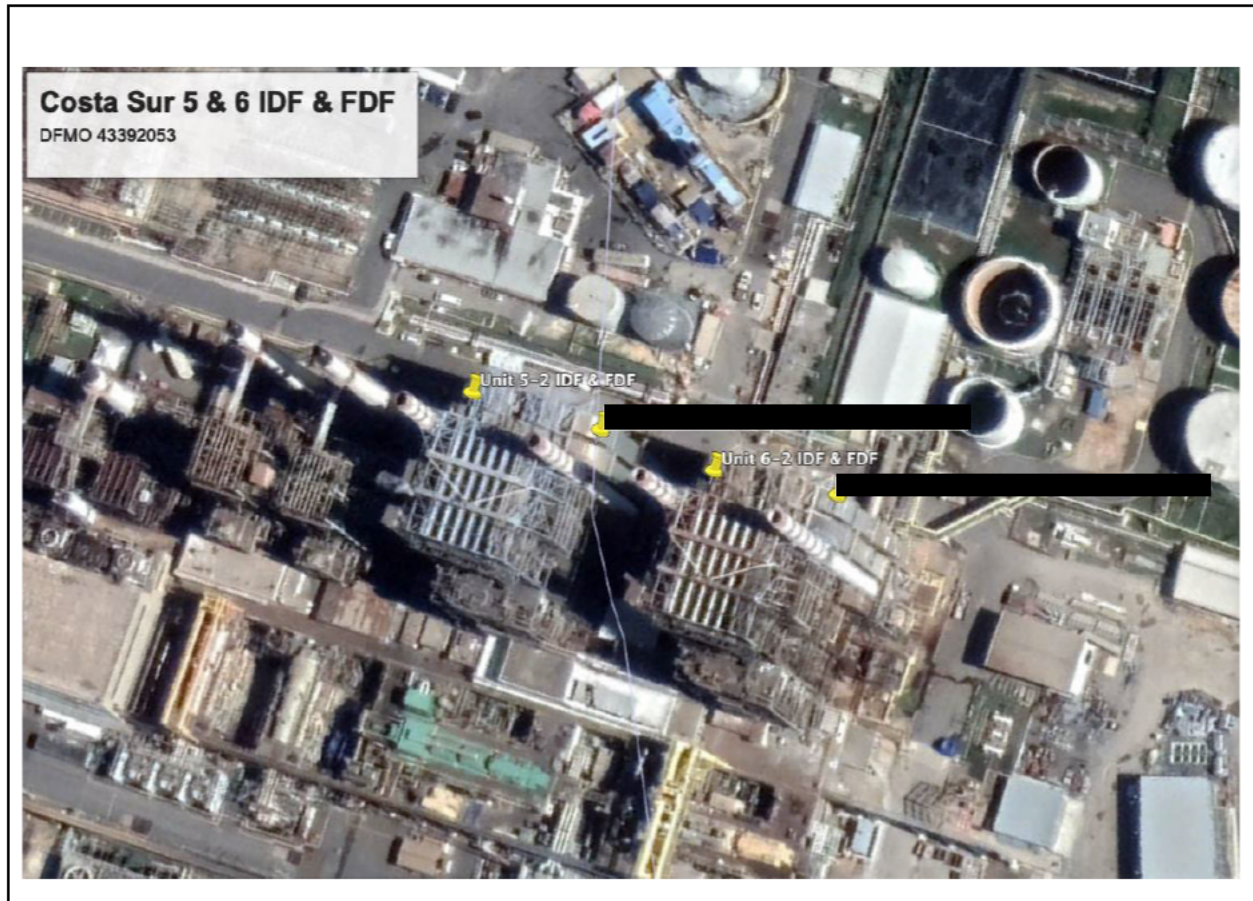
Please see attached the following supporting documentation:

- AEE_Manual_Teco_Westinghouse_Motor_2372AA_PREB_3053
- AEE_Manual_Teco_Westinghouse_Motor_3124AA_PREB_3053
- Especificaciones_Tecnicas_PREB_3053
- Memo_Justificación_PREB_3053_CR252640
- Memo_Justificación_PREB_3053_CR252642
- Proyectos_2022_Angel_Perez_Rev_IJR
- TS-E22-08_Existing_Motor_Main_Outline_PREB_3053

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures



10.4. Other: (Please Describe)

N/A



GOBIERNO DE PUERTO RICO
AUTORIDAD DE ENERGÍA ELÉCTRICA

Mario E. Miranda
Jefe División de Suministros

Miguel A. Beauchamp Ramos, Jefe Interino
Central Generatriz Costa Sur

SOLICITUD DE PRECIO, MANUFACTURA Y ENTREGA MOTOR HORIZONTAL 4500 HP PARA LOS ABANICOS DE TIRO INDUCIDO (IDF) UNIDADES 5 Y 6 DE COSTA SUR (CR 252640)

Solicitud de precio por un estimado de \$715,000.00 para la manufactura y entrega de un motor eléctrico de 4500 HP de motura horizontal para los abanicos de tiro inducido (IDF) de las Calderas Unidades 5 y 6 de Costa Sur. Incluye un set de *bearing* de repuesto de acuerdo a las especificaciones.

Cada Caldera de Costa Sur tiene un set de abanicos de tiro forzado y tiro inducido. El abanico de tiro inducido controla el flujo de gases que sale de la Caldera. Este abanico junto con el abanico de tiro forzado mantienen una presión negativa dentro de la Caldera para controlar la combustión que genera el calor para producir vapor de agua. Esto garantiza la confiabilidad de la operación de las Calderas a los cambios de carga del Sistema Eléctrico.

Los cuatro (4) motores de abanicos de tiro inducido instalados en las Calderas tienen 30 años en servicio. Cuando se avería uno de estos motores, se queda la Caldera limitada a media capacidad en lo que se repara el motor averiado. El tiempo de reparación de un motor puede tomar más de un mes de trabajo en un taller de reparación en Puerto Rico.

Por esta razón debemos mantener un motor *spare*, por lo que se justifica la solicitud de esta compra.



Apartado 364267 San Juan, Puerto Rico 00936-4267

"Somos un patrono con igualdad de oportunidades en el empleo y no discriminamos por razón de raza, color, sexo, edad, origen social o nacional, condición social, afiliación política, ideas políticas o religiosas; por ser víctima o ser percibida(o) como víctima de violencia doméstica, agresión sexual o acecho, sin importar estado civil, orientación sexual, identidad de género o estatus migratorio; por impedimento físico, mental o ambos, por condición de veterano(a) o por información genética."



GOBIERNO DE PUERTO RICO
AUTORIDAD DE ENERGÍA ELÉCTRICA

Mario E. Miranda
Jefe División de Suministros

Miguel A. Beauchamp Ramos, Jefe Interino
Central Generatriz Costa Sur

SOLICITUD DE PRECIO, MANUFACTURA Y ENTREGA MOTOR HORIZONTAL 1750 HP PARA LOS ABANICOS DE TIRO FORZADO (FDF) UNIDADES 5 Y 6 DE COSTA SUR (CR 252642)

Solicitud de precio por un estimado de \$445,000.00 para la manufactura y entrega de un motor eléctrico de 1750 HP de motura horizontal para los abanicos de tiro forzado (FDF) de las Calderas Unidades 5 y 6 de Costa Sur. Incluye un set de *bearing* de repuesto de acuerdo a las especificaciones.

Cada Caldera de Costa Sur tiene un set de abanicos de tiro forzado y tiro inducido. El abanico de tiro forzado controla el flujo de aire que entra a la Caldera. Este abanico junto con el abanico de tiro inducido mantienen una presión negativa dentro de la Caldera para controlar la combustión que genera el calor para producir vapor de agua. Esto garantiza la confiabilidad de la operación de las Calderas a los cambios de carga del Sistema Eléctrico.

Los cuatro (4) motores de abanicos de tiro forzado instalados en las Calderas tienen 42 años en servicio. Cuando se avería uno de estos motores, se queda la Caldera limitada a media capacidad en lo que se repara el motor averiado. El tiempo de reparación de un motor puede tomar más de un mes de trabajo en un taller de reparación en Puerto Rico.

Por esta razón debemos mantener un motor *spare*, por lo que se justifica la solicitud de esta compra.



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GOVERNMENT OF PUERTO RICO
PUERTO RICO ELECTRIC POWER AUTHORITY

Project number: 53

Project name: Procurement of Induced Draft Fan (IDF) and Forced Draft Fan (FDF) spare motors for units 5 & 6

Estimated cost: \$870,000

Contract Request: 252642

Contract Request: 252640

Scope of work

In a boiler, the Force Draft Fan (FDF) is the auxiliary equipment that delivers air to the furnace for the combustion process. In the other hand, the Induced Draft Fan (IDF) retrieves the flue gases from the furnace, keeping the furnace at a negative pressure to avoid flue gas leakage through the enclosure and ports. Two FDFs and two IDFs are required for a full load operation. The loss of any of them redounds in a unit limitation of 50% of the load. Since there is not a suitable spare motor for those Fans and considering the extensive downtime period to refurbish a damaged motor (over three months) it is cost effective to purchase a spare motor for each fan. Thus, the scope of this project is to purchase two motors: one for the IDF (4500hp) and one for the FDF (1750hp).



PO Box 364267 San Juan, Puerto Rico 00936-4267

"We are an equal opportunity employer and do not discriminate on the basis of race, color, gender, age, national or social origin, social status, political ideas or affiliation, religion; for being or perceived to be a victim of domestic violence, sexual aggression or harassment, regardless of marital status, sexual orientation, gender identity or immigration status; for physical or mental disability, for veteran status or genetic information."

**TECHNICAL SPECIFICATIONS FOR THE PURCHASE OF TWO NEW
HORIZONTAL ELECTRIC INDUCTION MOTORS TO DRIVE THE FORCED
DRAFT FANS AT AGUIRRE STEAM PLANT UNITS 1 AND 2 IN SALINAS AND
SOUTH COAST STEAM PLANT UNITS 5 AND 6 IN
GUAYANILLA, PUERTO RICO**

**TECHNICAL SPECIFICATION
REV. 4 @ APRIL 21, 2009**

A. Scope

These Technical Specifications are prepared for the purchase of two (2) new horizontal electric induction motors, which shall be used to drive Aguirre Steam Plant Units 1 and 2 and South Coast Forced Draft Fans Units 5 and 6. The new motors shall be interchangeable in order to be used at either generating unit. The motors shall be installed on existing facilities at indicated locations, and shall be used as a substitute of existing motors.

The motors shall be delivered within 270 consecutive days after drawings approval. One motor shall be delivered to Aguirre Steam Plant and the other one to South Coast Steam Plant. This is a turn-key project which shall be awarded to only one Bidder.

B. Kind of service

1. Technical data of driving (existing) equipment

The motors shall be used as a substitute to existing equipment of the same capacity at Aguirre Steam Plant Units 1 and 2 and South Coast Steam Plant Units 5 and 6. The new motors shall be designed to fit in the existing bases without modifications to the existing facilities and shall be capable to drive the following horizontal forced draft fans. Existing or original motor specifications and characteristics are provided as a reference in section I.A of Addendum A: "Proposal to Supply Electric Motors", and in Addendum B, included as part of these Technical Specifications.

2. Technical Data of Driven Equipment

Driven Equipment Operational Specifications	
Manufacturer	Sturtevant
Type	4109 DWDI- Argt-3 Airfoil Fan
Construction	Housing Welded

Driven Equipment Operational Specifications	
Application	Forced Draft Fan
Static Pressure	17.90"H ₂ O design, 12.55"H ₂ O peak, 12.10"H ₂ O max
Airflow (84 degrees F)	559,000 CFM design, 437,000 CFM peak, 430,000 CFM max
Brake Horsepower	1850 RPM design, 1160 HP peak, 1130 HP max
Nominal Speed	600 RPM
Duty	Continuous

C. Ambient operational conditions

New motors will be installed at sea level and will operate in a tropical climate zone, at an ambient temperature of 40° C. Motors shall be operated continuously at full load during a natural year (8,760 hours). This equipment will be operated at an area subject to severe dust and mild salt spray due to prevailing winds. Hurricane winds of 150 miles per hour (50 lb/ft²) may be originated at the area where the motor will be installed. The motors shall be capable to withstand these winds without damages or negative effects on its operational characteristics.

D. Capacity and performance

The new motors shall be of general-purpose characteristics, with heavy-duty design and construction. They shall be squirrel cage type, horizontal with one thousand seven hundred fifty (1750) horsepower capacity, preferably identical to existing (original) motors characteristics as indicated at Section I.A of Addendum A: "Proposal to Supply Electric Motor", but with modern design and construction and high operational efficiency.

E. Type of equipment to be acquired

1. Standard manufacturing

Unless inconsistent with this specification, the Contractor shall supply equipment of standard construction as per industry manufacturing standards and policies for the construction of electrical motors.

2. Standards and applicable codes

Unless otherwise specified herein, the latest applicable standards of the American National Standards Institute (ANSI), Institute of Electronic and Electrical Engineers (IEEE), National Electrical Manufacturers Association (NEMA), Electrical Apparatus Service Association (EASA), and all other applicable standards or codes of other organizations related to electrical motors design, construction or operation, shall govern.

3. Construction

The equipment shall be manufactured to operate within appropriate safety standards, taking in consideration not only the equipment, but also the operating personnel. They shall operate in a proper way within the operational requirements described or implied in this specification without undue strain, wear, heating, vibration, corrosion, or other operational troubles.

4. Materials used in motors construction

The equipment and all of its components and parts shall be capable to operate at high temperatures or other severe conditions, and they shall be constructed with the best available materials adequate for the required service. Toxic or other hazardous materials, parts or paints shall not be used. PREPA may require, at any moment, the Materials Safety Data Sheet of any product used in the manufacturing of this equipment.

5. Replacement parts

Parts subject to wear, corrosion or other deterioration, or requiring adjustment, inspection, or repair caused by normal use shall be accessible and capable of reasonable and convenient removal when required. Diagrams and/or instruction manuals for the replacement of such parts shall be provided with the motor.

6. Threads of bolts, nuts, stud and screws

Bolts, nuts, studs and screws shall have threads conforming to ANSI Standards, preferably in integer unit measures (whole numbers) in the English System. In the event that the equipment and its threaded components are constructed using the metric system, this fact shall be indicated in the Exceptions section of Addendum A and in the quotation submitted to PREPA. Only hexagonal nuts shall be used.

7. Lifting points

Threaded holes to attach eye bolts of standard size in the English System and of common use, shall be provided on the external frame of the motor to allow the lifting of the equipment in a safe manner including the heaviest components.

8. Support points

Support points provided by the manufacturer shall be designed for reasonable convenient connection to the foundations or supports at the installation site.

9. Electrical insulation materials

Insulating materials used in motors construction shall be of the best quality available and shall comply with the latest ANSI, NEMA, IEEE Standards, and the Electric Apparatus Service Association (EASA). The use of asbestos material is totally prohibited.

10. Conflicts or discrepancies

In case of conflict between standards, the more stringent requirements will apply.

F. Proposal required information

Bidders shall include the following information in their proposals as part of Addendum A: "Proposal to Supply Electric Motors":

1. Standards fulfillment:

Bidders shall confirm on Addendum A that the motors offered complies in their design, construction and materials used with the latest applicable standards and regulations from the following organizations:

- a. American National Standard Institute (ANSI)
- b. National Electrical Manufacturers Association (NEMA)
- c. Institute of Electrical and Electronics Engineers (IEEE)
- d. National Electric Code (NEC)

2. Repair shops

Bidders shall provide the name, contact information and location of authorized repair shops in PR or Continental USA in which repair works necessary to be performed during and after motor warranty period will be done in an effective and fast manner.

3. Utilities using referred equipment

Bidders shall provide in the required space of Addendum A, a list of Power Utilities (including contact person and telephone numbers) using the offered motor of similar capacity and design for a period of five (5) years or more.

4. Technical information required for repairs

Bidders shall provide for evaluation all technical information, including drawings, required and necessary in the event of any motor repair (beyond its warranty period) by a local motor repair shop, taking in consideration that PREPA has to issue public bids to perform this type of work.

5. Electric insulation

Details of insulation class and treatment given to stator coils of motor shall be provided.

G. New motor electrical specifications

The following information defines PREPA requirements for the new motors to be supplied by means of this specification. These requirements are based on existing motors nameplate data, included as reference in Addendum A, "Proposal to Supply Electric Motors" and the operational experience with existing equipment. Requirements on this section may be stricter than original requirements to improve or correct existing problems with old equipment.

1. Design requirements

The new induction motor shall be squirrel cage type as per the following specifications:

New Motor Electrical, Physical and Operational Specifications	
Generic Design and Motor Type	Horizontal, Squirrel Cage Induction Motor
Horsepower Capacity	1750 HP
Stator Winding Configuration	Wye
Type of Squirrel Cage Motor and Electrical Characteristics	Normal starting torque and normal current, equivalent to NEMA Design B motors.
Rated Voltage	4,000 VAC
Nominal Voltage	4,160 VAC
Phases	3
Frequency	60 Hz

New Motor Electrical, Physical and Operational Specifications	
Nominal/Full Load Speed	600/595 RPM (Data from existing motors)
Service Factor	1.15
Insulation/ Enclosure	Class F/ WP II
Temperature Rise @ 1.15 SF	80° C (by resistance)
Duty	Continuous
Full load Amps	232 max (data from existing motors)
Stator RTD's	Copper 10 ohm @ 25°C
Bearing Thermocouples	Copper Constantan Dual Element
Rotor and Stator Bars	Copper or Approved Copper Alloys
Torque (data from existing motors)	13,900 lbf-ft starting, 32,400 lbf-ft breakdown
Nominal Rotational Inertia (data from existing motors)	10,000 psf
Motor weight (data from existing motors)	20,800 lbs

2. Other requirements

a. Rotation and axial play

The shaft rotation shall be bidirectional. Total rotor endplay shall be adequate to the specific characteristics and application of the motor as per NEMA MG 1-20.81.

b. Service factor

The motor shall be capable to be loaded up to 1.15 times its nominal capacity of 1750 HP and its load equivalent in amperes at nominal voltage, frequency and temperature, without exceeding the 80°C temperature rise.

c. Frame and foundations

The frame of the new motor shall be of similar physical characteristics and dimensions of existing motor frames, in order for the new motors to be installed directly and without modifications to the existing installations or bases at the plant.

If the motor needs a transition or adaptor piece to match existing dimensions and shaft height, the Supplier shall and must provide it with the motor. The transition piece provided shall be designed so that it matches existing base foundation dimensions and can be installed directly and without modifications to the existing bases and/or facilities. (Note: Since two motors are purchased, the Supplier shall provide one base for each motor.)

No matter the information provided by PREPA (due to the lack of information and drawings of these motors), the Supplier is sole responsible to check and verify in place the actual dimensions in order that the new motors can be installed directly and without modifications to the existing bases and/or facilities.

d. Winding insulation temperature measurement

This temperature shall be measured by a minimum of six copper, 10 ohms RTD's, factory embedded and equally distributed around the 360°. The temperature rise specified shall never be exceeded by any part of the operating equipment, nevertheless that the motor be operated continuously at its maximum electrical and mechanical power, including its additional capacity provided by the service factor specified above its nominal capacity.

e. Bearing thermocouples and thermometers

Each motor bearing shall include the following equipment:

1. One thermocouple Copper Constantan Dual Element provided with its wiring and independent connection box. See Section H.13.d.
2. One dial thermometer, helix type bimetal element, 3 inch diameter head (minimum), 0.5 inch NPT male connection nut, rugged 304 SS construction, 0°F to 240°F dial range, 2° divisions, back connection and an appropriate stem length for the application.

f. Thermal resistors

The motor shall be provided with thermal heating resistors (space heaters) of adequate capacity to operate at 120 volts, one phase, and 60 hertz. The space heaters shall never be in contact with the stator windings. The

motors shall include an independent connection box of appropriate size with the provisions to connect the heaters to the existing facilities. The thermal resistor shall be installed so as to transfer the heat to the core instead of the winding, keeping at least 10°C over the environment (ambient) temperature (approximately 40°C), insuring that no internal water vapor condensation occurs inside the new, proposed equipment.

3. Electrical insulation technical requirements

a. General characteristics

The motor shall be provided with class F (non-hygroscopic) insulation with design and operational characteristics adequate to be operated in an ambient and conditions usually found in the power plants. They are located in a tropical zone close or near sea level. The insulation shall have anti-fungi properties. The insulation shall have integrity and shall be sealed and made with materials capable to protect against the detrimental effects of high (100%) relative humidity, oil and chemicals.

b. Insulation methods

Insulation method required for the conductors, coils and material in motor windings shall be vacuum pressure impregnated ("VPI") or solvent less B-stage Epoxy-resin rich tapes. Whenever VPI is not utilized, after coils are completed, the stator assembly shall be completely flooded by immersion with the best available dirt resistant insulating varnish, drained and baked, producing a sealed, dry and smooth external winding surface. Conventional winding insulation methods not expressly indicated in this section will be rejected. Any insulating method used on motors fabrication shall improve coil performance and motors life in severe environments and eliminate all corona-generating points on the windings.

c. Windings and end turns

The windings and end turns shall be firmly braced and firmly secured to avoid vibrations. The contractor, supplier or manufacturer shall verify that end turns do not interfere with the installation and removal of the motor rotor, with its normal operation and with the future assembly and disassembly.

4. Starting and operating requirements

For the purpose of being able to evaluate bidder proposals, the following information, expressly confirming requirements fulfillment as specified or differences as applicable, shall be provided on bid proposal. Not providing

required relevant information may render proposal as non-responsive (no-bid) at PREPA discretion.

a. Rotation

Motor electrical and mechanical characteristics shall allow the motor rotation and cooling system to be bidirectional.

b. Starting characteristics

The new motor minimum starting torque requirement shall be 100% of the load. The breakdown torque shall be equal or greater than 180% of the load. Motors shall be capable of across the line starting, and accelerating with 100% mechanical coupled load, up to rated (nominal, nameplate) speed including the service factor required. Motor shall be capable of two consecutive starts, and a third start within fifteen minutes to forty five minutes after the second start without any detrimental defect to its mechanical and electrical design characteristics and related components (NEMA MG 1-20.43).

c. Operational voltage limits

Motor shall be capable of continuous operation at full load with eighty percent (80%) nominal voltage on its power leads, and shall satisfy starting requirements in a range between 80% to 120% of nameplate's nominal operation voltage (NEMA MG 1-20.45).

d. Operational current limits

Full load current when operating within ten percent (10%) of rated voltage shall not exceed by more than fifteen percent (15%) rated full load current (1.15 times) including the power factor.

e. Operational time and starting current limits

1. The real starting current of the motor shall not exceed the established limits of the KVA per horsepower.
2. The locked rotor time interval shall be equal or greater than the maximum acceleration period (in time) when the equipment is started with maximum load, including the service factor, at minimum voltage limit (80% of the nominal voltage), without any detrimental effect to the operating equipment.

f. Winding temperature increment

Winding real temperature increment, when operating the equipment continuously at its nominal full load and mechanical capacity, including the specified service factor, shall not exceed the temperature rise limits as specified and required.

g. Grounding connections

Motor shall have provisions for grounding according to latest NEMA MG2-209 revision and all other applicable standards. The motor shall have two (2) suitable grounding pads, one located on main conduit lead box side of motor, and the other in opposite side, both on or near the frame base, capable of accepting #4/0 AWG copper conductors for this purpose.

h. Operating speed

The nominal speed of the new motor shall be 600 RPM. The full load speed of the new motor shall be no less than 594 RPM.

5. Rotor specifications:

a. General

Motor rotor bars and rings of the squirrel cage type shall be constructed using copper or copper alloys approved for this kind of equipment with appropriate structural reinforcements for adequate operation and failure prevention. Proposals offering motors with aluminum conductors/bars will be rejected.

The number of rotor flutes shall not be equal to the number of poles of the motor in order to permit the use of predictive equipments without electrical interference or distortion.

Coils ends shall be braced with surge epoxy rings end castings. Care must be taken with these rings so that it shall not interfere with rotor installation or removal.

b. Mechanical balance of the rotor

The rotor shall be statically and dynamically balanced (at its nominal load and speed) in accordance with the requirement of the standard MG-1-20.53 and its latest recommendations and revisions. When new mechanical couplings are requested to be included with the motors, the balance shall be done with the coupling installed on the motor.

c. Vibrations

The vibrations of the motor, at its maximum load and nominal speed, shall not exceed an amplitude of one mil of an inch (0.001 inch) crest to crest, in accordance with the recommendations of the IEEE Standard 7-16-1969 as revised 9-15-1982 or its most recent revision. In relation to the equipment characteristics referred to the horizontal, vertical and axial vibrations, the Supplier shall submit for any equipment supplied to the Authority, the following:

- Estimated horizontal, vertical and axial vibrations as expected for the equipment (motor with its transition base, if applicable).
- Tolerable limits of vibration in normal operation and recommended limit for shut down.
- Vibration and current spectrum of the equipment manufactured for PREPA.

Note: The manufacturer may supply these data in his preferred measurement units, but it shall include at least one set of data in inches/second.

d. Design materials and construction

New motors design, materials and construction shall secure the most reliable service, the best operation characteristics, oscillation elimination and the lower possible noise measured as per IEEE standard 85 and its latest revision.

H. Mechanical specifications

1. Lubrication system

The motor shall be provided with two (2) split sleeve bearings, as described on Item H.2 below, designed to operate by means of a self lubrication system, presently in service with the existing motors. The lubricant or oil shall be supplied to the bearing or equipment during its start up, operation and shut down by means of the required lubrication system.

2. Bearings

Heavy-duty sleeve bearings are required by PREPA, preferably of the outboard type. They shall be of easy removal, bi-directional, split housing, and lubricated by means of a self-lubrication system. The bearings shall be constructed as per NEMA and any other applicable standards for the design, for the materials to be used and for the construction of motor bearings for the specific application of the reference motor. Bearings shall be appropriate to operate under the conditions established for the motor operation. They shall be sealed against leaks and vapors

of the lubricant to the interior of the motor. They shall also be sealed externally against the incoming moisture, dirt and dust.

The bearing housing shall provide, for each bearing, in an adequate location, drain plugs that could be easily removed when necessary. Lines with adequate valves shall be provided to allow for oil sampling for each bearing and/or for the main tank(s) of the lubricant. These lines for oil sampling shall not be taken directly from the bottom of the bearing or tank reservoirs where sludge precipitates (to avoid sediment in the samples). Facilities to add and remove oil easily shall be provided. Ball bearings will not be accepted as an alternative to the main proposal. Proposals of motors with ball bearings will be rejected.

Bidders shall quote for two spare sets of bearings as an option to be evaluated at PREPA discretion, one for each motor. Each set will include a front end bearing assembly and one rear end assembly. Each assembly must include the following: housing, bearing liners, bearing seals and lubrication rings. If the assemblies are identical, two shall be provided.

For evaluation purposes this option shall be evaluated as part of the main bid.

3. Bearing electric insulation

One of the motor bearings shall be electrically insulated to eliminate the possibility of circulating eddy currents through the shaft and journal with their detrimental effects. One and only one of the bearings shall be designed and constructed to drain or allow the current flow to ground without any detrimental effects to equipment.

4. Mechanical couplings

The new motor shall use existing couplings without any required modification. Bidders are responsible to inspect and verify in site the existing couplings at the equipment. If the new motor needs a different coupling, then it shall be included with the motors without additional cost to PREPA. The load side of the coupling shall be supplied without perforation (blind).

5. Frame

The new motors frame shall be similar to the existing motors physical characteristics and shall be designed for its direct installation without any modifications to the existing bases and power connection facilities, as specified in Articles B.1 and G.2.c.

Included in Addendum B are drawings and additional information of the existing motor, which shall be used as a reference guide for the design of the new motor. No matter the information provided in this drawing, the Supplier is sole

responsible to check and verify in place the actual dimensions in order that the new motor shall be designed and installed directly and without modifications to the existing bases and/or facilities. Exceptions between existing dimensions and the new equipment shall be indicated on corresponding Section VI "Exceptions" of Addendum A. Any repairable difference or discrepancy between the offered or supplied equipment and the existing installation or equipment shall be explicitly indicated in Section VI "Exceptions" of Addendum A: "Proposal to Supply Electric Motor".

6. Inspection Peepholes

Motors with sleeve bearings shall have inspection peepholes to visually inspect the lubricant flow and ring sight gauges to see the oil level and condition. They shall be constructed using clear glass. The sight gauge shall be provided with a drain plug of easy removal for each one of the bearings.

7. Allowable axial displacements

The maximum axial displacement allowed to the shaft, motor endplay, shall be as required in Article G.2.a. This should be measured from both ends of displacement up to the magnetic center of the rotor at maximum load and nominal speed. The magnetic center and its allowable limits shall be clearly indicated and identified on the journal housing and/or on the motor frame.

8. Frame characteristics

The motor frame shall be designed so that it could be easily cleaned without the necessity of dismantling the equipment for this purpose. The cooling vents shall be provided with stainless steel protectors or screens and reusable air filters with their filter housing if applicable (filters shall be provided). The required external housing is Weather Protected Type II (WP-II).

9. Connection boxes characteristics

The connection boxes for the power leads (see section H.13.a for further details), RTD's, thermocouples and heaters shall be of appropriate dimensions and with enough space to allow the connection and disconnection easily. The connection boxes shall be located in accordance with the existing motor boxes location or as per supplied diagram by PREPA if a written requirement is made by the bidder or supplier.

10. External protective paint

All the external components exposed to the ambient or subject to heating being fabricated from cast iron, iron, steel or carbon steel shall be painted in factory with at least two layers of the best quality paint in the market and shall be heat, oil

and dirt resistant. They shall resist ambient effects as they apply in accordance with the best industry practices on the equipment manufacturer. All the other components and parts made in iron, steel or steel alloy, not exposed to the ambient or subject to high temperatures, shall be finished in factory with at least one priming coat plus a second external coat in order to obtain minimum thickness of 4.5 mils. The primer should be a red iron oxide zinc chromate alkyd of .75 to 1 mil adequate to protect equipment against corrosion in the conditions and location of the equipment in a tropical zone. The outer paint layers shall be as per manufacturer standard color or as per instructions supplied by PREPA through its representative. Motors external frame and parts shall be completely painted. No lead-based paints shall be used.

11. Personnel qualifications and labor development requirements

All work shall be performed and completed in a thorough workmanlike manner and shall follow the best modern practice in the manufacture of materials and apparatus of the type covered by this specification, without any omission from the specification or drawings. All parts shall be made accurately and to standard gauge, where possible, so as to facilitate replacement and repairs.

12. Range of preferred weight

New motor total weight shall not exceed existing motor weight of 20,800 lbs. However, PREPA reserves its right to approve and accept new equipments proposed with additional weight up to 15% above existing motor weight.

13. Requirements to adapt the motor to the existing facilities

a. Power leads

Stator leads shall extend at least 36 inches beyond the frame. The power conductors shall be constructed of super stranded copper conductor or approved copper alloys of the appropriate gauge for this particular application. The conductor insulation shall be super flexible with the required voltage capacity. The holes in the stator frame through which the leads extend shall be equipped with insulated bushings or substantial non-degradable material, designed to protect leads from chafing due to bending or friction. They shall be of ample dimension to permit them to be securely fastened to the frame.

The new motors shall have a second connection box containing a second set of the stator closing power leads, identical in dimension and located at the opposite side of the main connection box. The wye closing power leads shall be brought out appropriately with the phases identified with visible tags within both boxes, to permit proper and easy access for its connection.

b. Space heaters cables

The space heaters cables shall be provided with weatherproof electrical terminals and shall be brought out to a separated weatherproof connection box, which shall be used exclusively for this application.

c. RTD's & thermocouples cables

The stator temperature detectors and bearing thermocouples cables shall be brought out to a separate terminal weatherproof box on the motor frame for convenient connection. The leads and conductors shall be appropriate for this particular application.

d. Bearings thermocouples and thermometers

Motor bearings shall be equipped with dual element, type T thermocouples (copper constantan) and 3-inch dial thermometers, helix type bimetal element. They will be used to obtain temperature readings in the lubricated area.

Thermocouple leads shall be brought out to terminals located on an appropriate connection box at head assembly (see item c above). Head assembly shall be aluminum made and shall be painted with the color code for T-type thermocouples. Insulated holders shall be used as required to prevent static pick up. The head assemblies shall be arranged for convenient connection to PREPA existing conduits. The leads and conductors should be designed and constructed for this particular application.

e. Noise contamination

The no load overall sound power level (dBA reference, 10^{-12} watts) of these motors shall be less than 85 decibels when measured in accordance with IEEE Standard 85; and ANSI 51.2 and 51.3 and its latest revisions.

Proposals offering motors with an overall sound power level up to 90 dB will be evaluated and considered at PREPA discretion.

f. Winding temperature detectors

Stator winding temperature shall be measured by six (6) copper, 10 ohms at 25°C, factory embedded resistance temperature detector's (RTD's), two per phase. They shall be located and equally distributed in the 360° of the winding. The leads and conductors shall be designed and constructed for this particular application.

g. Inspection windows

Two inspection windows (if applicable) shall be provided, one on each side of the housing. These windows shall have handles and gaskets to protect from the ambient. They shall be of the appropriate dimensions to allow cleaning the lowest part of the motor.

I. Tests

1. General

The manufacturer shall make all necessary tests to ensure his material and workmanship are of the required degree of excellence and that the equipment furnished by him shall perform as specified and guaranteed. All tests shall be conducted in accordance with the latest applicable tests codes for this type of equipment from the National Electrical Manufacturers Association, the American National Standard Institute, the Institute of Electrical and Electronics Engineers and other related organizations.

The manufacturer shall provide PREPA all data obtained from the equipment tests as required. The obtained values shall be tabulated in each and every one of the tests and written certified including the graphs and curves obtained. Any test failure due to inability to meet appropriate parameters as required by PREPA and as proposed and guaranteed by the contractor, shall be considered sufficient cause for motor rejection.

2. Factory/Shop acceptance tests

Factory acceptance tests are required by PREPA. PREPA's intention is to witness factory tests to verify efficiency and performance parameters of the motors.

A notice with at least 45 days of anticipation time shall be given to PREPA to allow PREPA to make arrangements to send their representatives to witness the acceptance tests, if PREPA so desires.

The following minimum tests shall be made on the motors during factory acceptance tests:

a. Measurement of winding resistance

- b. Magnetic center determination
- c. Air gap measurement
- d. Bearing temperature rise at running speed
- e. No-load readings of current, voltage, power and nominal speed at rated voltage and frequency
- f. Mechanical vibration
- g. Direction of rotation versus phase sequence
- h. Insulation resistance
- i. High-potential test
- j. Determination of locked-rotor (zero-speed) torque and current
- k. Determination of speed-torque curve
- l. Determination of speed-current curve
- m. Temperature tests
- n. Sound measurement as per IEEE 85
- o. Shaft voltage test as per IEEE 112.9.4
- p. Determination of efficiency and power factor at 100% load

The results of the tests shall be sent to PREPA within ten (10) consecutive days after their completion and before equipment shipment to PREPA.

Cost of witnessed tests shall be quoted as an option. Travel, hotel and food expenses shall be the responsibility of PREPA. For evaluation purposes this option shall be evaluated as part of the main bid.

3. Motors efficiency tests

Motor efficiency shall be determined using IEEE 112 test method F. The results of the efficiency tests shall be used to determine motors compliance with the efficiencies offered by the contractor in his proposal.

Failure to meet offered efficiency shall be considered sufficient cause for motor rejection.

4. Alternative or simulated Tests

When operational factory acceptance tests at nominal voltage, current and/or speed cannot be accomplished at manufacturer facilities due to sound and valid reasons, including under capacity to operate the motor, then alternatives such as simulated tests at lower than nominal capacity can be performed. Alternative tests shall be authorized by PREPA in written, depending on the validity of the reasons to PREPA satisfaction. The obtained values shall be tabulated in each and every one of the tests and written certified including the graphs and curves obtained. The results shall be sent to the PREPA within five (5) days after the tests completion and before the equipment shipment to PREPA.

5. Additional tests

PREPA reserves its right to perform all necessary electrical tests to the motors or additional tests using its personnel or third party contractors before or after the final acceptance and installation at PREPA discretion.

J. Motor Drawings and Instruction Manuals

Supplier shall provide as part of new motors delivery a final AS BUILT set of drawings and motor instruction manuals in hard copy and Adobe Acrobat Reader (.pdf) format.



Instruction Manual

TECO-Westinghouse Motor Company
P. O. Box 277
Round Rock, TX 78680-0277
1-800-451-8798

24 Hour Field Service Support
1-800-247-6859

TECO-Westinghouse Motor Company
Operation and Maintenance Instructions

Presented To Our Valued Customer

Occidental International, Inc.

Instruction Book Number: 2372AA

T-WMC General Order: XH 21775

Application: ID Fan

T-WMC Shop Order: 2372AA

Enclosure: WP2

**Type: Horizontal Induction Motor
Metric Series**

Bearings: Sleeve

Rating: 4500 HP; 4000 V

January 8, 1998

Rev. 1

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Induction Motors	
Introduction	Part 1
General	Sect. A

GENERAL

This manual provides a description, recommendations and instructions for receiving, storage, handling, installing, operating and maintaining Horizontal Induction Motors.

Specific information relating to operation and rating will be found on the motor nameplates and tags. Dimensions and information required for foundation, main and auxiliary electrical connection, and driven equipment interfaces will be found on the motor outline drawing.

It is important to secure a copy of this outline first, see Figure 1, and review carefully all warning notes and nameplates related to this equipment.

Prior to storage of any apparatus or components thereof, read carefully all tags affixed to equipment or parts or crating and follow instructions fully.

On multiple machine orders, segregate all parts by shop order number.

For answers to any questions about storage or installation call 1-800-247-6859 Customer Service (M-F 8:00 through 4:30 p.m. cst).

For the manufacturer's warranty on this machine to be in effect, the equipment must be installed in strict accordance with this outline drawing and this instruction book.

All possible contingencies which may arise during the installation, operation, or maintenance of this equipment do not purport to be covered by these instructions.

Should questions arise that are not covered by this manual or outline, contact the nearest Westinghouse Sales Office.

All illustrations referred to in this text are identified as figures and contained in Part 10. Refer also to the index for listing of the figures.

It is recommended that frequent and careful references be made to the figures, pictures, etc. in Part 10 as a valuable aid in understanding and using this manual.

Induction Motors
Introduction
List of Instruction Book Parts

Part 1
Sect. B

LIST OF INSTRUCTION BOOK PARTS

This instruction book has these parts.

Part 1 - Introduction

2 - Installation

3 - Electrical Connections and Start-Up

4 - Inspection and Maintenance

5 - Bearings and Lubrication

7 - Accessories

8 - Renewal Parts

9 - Trouble Shooting

10 - Illustrations (Figures)

Induction Motors	
Introduction	Part 1
Major Motor Components	Sect. C

MAJOR MOTOR COMPONENTS

Type LLD-CS Squirrel Cage Induction Motors are designed and constructed for a wide variety of constant or multiple fixed speed operations. The versatility of these motors is achieved by the combination of constant and variable components. The major components of the motors are:

1. Frame and Stator Assembly
2. Bearing Bracket
3. Bearings
4. Rotor Assembly
5. Ventilation Enclosure

Within any given frame size, the frame and stator, bearing bracket, bearings and rotor assembly are essentially constant components that vary only in steps of frame length and in bearing size.

The ventilation enclosure is the variable component and can be changed, altered, or replaced at any time to provide the various degrees of motor protection or noise control required by specific operating conditions.

Refer to the cross section drawing Figure 2, for illustrative description of the major components and identification of the name and location of the various parts. Note that this is a general arrangement and that all motors may not be exactly as shown in all details.

Induction Motors	
Introduction	Part 1
General Description	Sect. D

GENERAL DESCRIPTION

Figure 2 in Part 10 shows the general arrangement of typical induction motors. The outline drawing, Figure 1, will identify the number and types of bearings, type of enclosure, shaft extension details, types of auxiliaries, output rating of the motor and some of the basic nameplate data.

FRAME AND STATOR ASSEMBLY

Frame

The stator frame is fabricated from electrically welded steel plate to form a rigid box assembly.

Wound Stator

The core assembly of stator laminations, vent and end fingers are clamped between steel endplates. Pre-formed stator coils are wound and wedged in the stator lamination slots. End turn sections are braced together and to insulated support rings to withstand the electrical forces of the motor starting. Coils are impregnated under vacuum and then pressure, using the Thermalastic® Epoxy system. The impregnation is performed either before winding or after coil connections are made. The method used is one that is most compatible with the motor characteristics.

Stator Leads

Stator lead marking and size of terminals, when provided, are shown on the outline drawing. On single speed motors, the main leads are marked T1, T2, T3.

Induction Motors	
Introduction	Part 1
General Description (continued)	Sect. D

Consult the outline drawing for specific rotation and lead markings. Review Part 3 of this manual regarding "Electrical Connections and Startup."

ROTOR ASSEMBLY

Squirrel-Cage

Squirrel-cage rotors are constructed of many silicon-steel laminations, vent and end fingers stacked and pressed between steel end plates. Heavy end plates prevent flaring of the laminations. The lamination-end plate assembly is keyed or welded onto a spider which, in turn, is welded or keyed to the motor shaft.

Uninsulated rotor-winding bars are fitted into slots in the lamination-end plate assembly and then machine swaged. Swaging tightens the rotor bars in the slots against the slot sides and thereby prevents rotor-bar vibration and fatigue failures.

The rotor-winding bars are always made of copper or copper alloy, because of copper's low electrical resistivity and its superior ability to withstand severe thermal stresses. Most important, copper permits a perfect joint between the rotor-winding bars and the short-circuiting end rings which are also made of copper.

The bars are high-frequency induction brazed, using silver brazing alloy, into machined grooves in the short-circuiting end rings.

Ventilation Description

All motors are designed to be self-ventilating. The ventilation system is common to all motor types regardless of ventilation enclosure configuration. Referring to the cross section drawing, Fig. 2, cooling air enters through top frame openings at both ends. A part of the cooling air enters the rotor fans and is forced through the stator winding end turns. The remainder of the cooling air is drawn through openings in the rotor core and discharged radially through the rotor ducts to the air gap where it enters and flows through the radial stator ducts. The exhaust air from the stator

Induction Motors	
Introduction	Part 1
General Description (continued)	Sect. D

ducts combines with the air from the stator winding ends and is discharged through the center section at the top frame.

All ventilation enclosures are designed to conform to the basic ventilation system described above. In addition, the ventilation enclosures are arranged internally to provide motor protection as required by NEMA motor enclosure type definitions.

For motors which are self-ventilated and not totally enclosed, sufficient clearances should be provided at the air intake and discharge openings, that discharge air may diffuse into the motor room or ambient with very little recirculation directly from discharge to intake. Excessive recirculation of ventilating air will increase the ingoing air temperature above the maximum permissible ambient, causing the motor total temperature to exceed its limits. Clearances from discharge ports should be at least equal to the largest dimension of the port, to minimize back pressure drop at the discharge. Sources of warm air such as from room heating ducts, or discharge of other motors should be arranged to prevent direct entry of this warm air into the motor air intake region.

When air filters and/or screens are applied to the intake and discharge parts, attention must be given to the cleaning or replacement of the filters when they become clogged, and to cleaning of clogged screens. The outline drawing will identify filters which must be cleaned.

Ventilation Enclosure - Types and Function

The ventilation enclosure of the LLD-CS horizontal motor determines the degree of motor protection.

Induction Motors are available in 8 types of enclosures:

1. Drip-Proof
2. Drip-Proof Fully Guarded
3. Weather Protected - Type I
4. Weather Protected - Type II
5. Totally Enclosed Water to Air Cooled (T.E.W.A.C.)

Induction Motors
Introduction
General Description (continued)

Part 1
Sect. D

6. Totally Enclosed Air to Air Cooled (T.E.A.A.C.)
7. Externally Ventilated (Blower Ventilated or Force Ventilated)
8. Pipe Ventilated

A brief description follows for a WP2 type enclosure. For additional specific information, review the outline for the shop order and look at the appropriate figures in Part 10 of this book.

Weather Protected Type II

The standard WP2 enclosure is a fabricated sheet metal box designed to protect the motor from adverse weather with the motor running or stationary. The standard arrangement is for cooling air inlet at one side of the enclosure through screens or filters. The cooling air enters the frame ends after passing through well baffled low velocity ducts. The heated discharged air enters the enclosure from the top of the frame and passes through well baffled ducts to discharge from the opposite side of the enclosure. "Blow-through" passages are provided in both inlet and exhaust to prevent pressure build up by high velocity winds.

THE MACHINES ON THIS ORDER HAVE THE ENCLOSURE AND VENTILATION AS SHOWN ON OUTLINE FIGURE 1 AND HAVE AIR FLOW AS INDICATED ON FIGURE 2.

Induction Motors
Introduction
General Description (continued)

Part 1
Sect. D

ENCLOSURE OPTIONS

Inlet Air Filters

Air filters and holding frames are supplied only when specified. If the need for air filters arises after initial operation, contact the nearest Westinghouse Sales Office for information about filter and holder availability.

Unless otherwise specified, a galvanized steel element filter is provided. The filters are arranged so that all of the cooling air is drawn in through them. The filters are recleanable and must be removed periodically for cleaning and re-oiling to prevent the motor from overheating or becoming dirty due to loaded filters. The filters provided with this motor are "face loading-non-clogging" filters. When loaded with dirt, they will permit the air flow to carry dirt into the motor, but will not clog to completely shut-off the air flow. Check the back of the filter panels to see if they are loaded. There are several ways to determine when filters need to be recleaned. If the machine has stator temperature monitoring devices, the stator temperature rise over the ambient cooling air is one indication of filter performance for a given load or reasonably small load range. If the machine does not have stator temperature devices, or if the load fluctuates, a manometer connection can be provided when specified or installed later to measure the air pressure drop across the filter. The manometer connection is a pipe or tube arranged to sense the pressure behind the filter inside the enclosure, and is accessible outside the machine. By connecting one leg of a U-Tube manometer to the connection, the pressure drop across the filter is directly indicated. It is recommended that an initial pressure drop reading be taken with clean filters to establish this value -- generally, .12 inches or less depending on the motor speed. Periodically, recheck the pressure drop and when it has approximately doubled, or reached a value of .24 inches of water, or if the stator temperature starts to rise, remove and clean the filters as described in the Maintenance Section - Cleaning.

Induction Motors	
Introduction	Part 1
General Description (continued)	Sect. D

Another device that can be supplied when ordered is an air pressure differential switch that continuously monitors the pressure drop across the filters and actuates an electrical circuit for warning or control purposes when the pressure drop reaches a preset value. The switch can be supplied with an adjustable range for the pressure drop that actuates the electrical circuit.

With any of these methods, it is difficult to establish rules applicable to all situations. The user is advised to develop his own filter removal criteria by any combination of the described methods that results in minimum dirt accumulation inside the motor without jeopardizing the stator winding temperature. It is also recommended that a spare set of filters be kept on hand so that clean filters are always available and filter cleaning can be done at any convenient time.

Acoustic Treatment

Acoustic treatment is supplied with the machine when noise level considerations indicate the need. The treatment generally consists of an acoustically absorbing fiberglass mat with a protective coating on one side of the mat. The mat is suitably supported to hold it in place and the protective coating prevents impinging air from shredding the fiberglass. The simplest form of treatment consists of applying the acoustic absorbing material to the inside surfaces of the ventilation enclosure, and/or the basic frame structure.

The acoustic absorbing material requires little maintenance. If the protective coating is dusty, wipe or blow the dust away . . . do not blow directly on the protective coating with a high pressure air jet. If the acoustic fiberglass is oil soaked, replace it to reduce fire hazard.

Induction Motors	
Installation	Part 2
Shipment and Receiving	Sect. A

SHIPMENT AND RECEIVING

Prior to shipment, all motors undergo electrical and mechanical testing. After completion of tests, each motor is covered with heavy weather-resistant sheeting for shipment by a common carrier. Motors to be shipped overseas may be crated.

Machine will be shipped assembled. Consult the outline drawing Figure 1 and/or shipping invoice to determine what items are to be received and check to see that all were delivered. Inspect the packaging for any signs of damage. If any shortages exist, or evidence of damage is found, notify the carrier and the nearest Westinghouse Sales Office. It is advisable to unpack damaged equipment in the presence of a representative of the carrier. If unnoticed damage is discovered later, notify the carrier immediately and request an inspection before proceeding with installation. In any correspondence with Westinghouse, be sure to include all data stamped on rating nameplate including style and serial numbers.

Induction Motors	
Installation	Part 2
Lifting and Handling	Sect. B

LIFTING AND HANDLING

All lifting should be done by means of lifting bars or lifting holes. See outline drawing Figure 1 for lifting means provided and total motor weight is 32,650*. Never lift or support the stator by the core punchings or coils. When lifting completely assembled machines which are mounted on a bedplate, slings should be attached in the openings on the bedplate. Arrange the slings so that the weight is distributed uniformly and use care to avoid distortion of the bedplate.

It is easily possible, by rough handling or careless use of bars or hooks, to do more damage to a machine before or during erection than would be done in years of regular service.

If the motor is to be set in a temporary location, lower the motor, or components, onto supports that are reasonably level.

Care should be taken in transporting and handling the machines to see that the windings are not damaged. A blow upon any part of the windings is likely to injure the insulation and result in the burning out of a coil.

- * In general, four lifting lugs are provided on the frame for lifting the complete motor. A four leg chain, or sling of suitable load rating and with legs as long as possible, is required. The angle between any leg and the horizontal must be 45 degrees or greater if spreader bars are not used. The ventilation enclosure can be lifted separately by lifting holes or lugs located on the top of the enclosure.

WARNING Do not use enclosure lifting holes or lugs for lifting entire motor.

If a heavy coupling or other attachments unbalance the load, additional slings should be used to prevent tipping.

Induction Motors
Installation
Lifting and Handling (continued)

Part 2

Sect. B

Shipping Brace

A shipping brace (painted yellow) designed to prevent motion of the rotor is supplied and should be installed at all times when the assembled motor is being moved. Failure to utilize this brace could result in damage due to axial movement of the rotor. The shipping brace should be retained for use at future dismantling.

Induction Motors	
Installation	
Machine Test and Maintenance Reports	

Part 2

Sect. C

MACHINE TEST AND MAINTENANCE REPORTS

Any test data, especially certified test data, relating to this motor should be placed in this section for ready reference.

Also, file here any additional notes that relate to the installation, measured air gaps, operation, maintenance, or repairing of this machine.

Certified test data has been supplied for this motor. The test report delivered should be placed in this section for ready reference.

Induction Motors
Installation
Motor Nameplate Data

Part 2

Sect. D

MOTOR NAMEPLATE DATA

Motor Nameplate data should be recorded from the nameplate and retained where the data can be checked easily when needed. Data which is of particular value is:

1. Full load current, locked kVA code, and insulation.
2. Rated voltage, horsepower, frequency, and ambient.
3. Service factor and serial number.

Additionally, a special note should be made of information on warning nameplates and limitations on starting as defined by the starting limits nameplate.

Induction Motors
Installation
Equipment Data

Part 2
Sect. E

EQUIPMENT DATA

General Data

For the manufacturer's warranty on this equipment to be in effect, the equipment must be installed in strict accordance with the outline drawing and procedures outlined in this instruction book.

When the motor is installed and particularly when it is shipped unassembled from the factory and on those occasions when the equipment is to be reassembled following disassembly, it is necessary to refer to the data which appears on the outline drawing, Figure 1. This data may include:

1. Motor foot height including shims.
2. Bearing insulation and cross sections of insulated dowel.
3. Location and size of dowel holes in feet of motor.
4. Location of lifting lugs, eyebolts, etc.
5. Weight of motor.
6. Limit lines for housings, cooler removal or cleanout, rotor removal.
7. Location of ventilating air intake and discharge ports and air flow data.
8. Coupling dimensions.
9. Recommended grout line, pit depth and width.
10. Voltage sequence and machine rotation.
11. Input power, voltage, etc. to thermostats, auxiliary heaters, pumps and similar powered devices.
12. Identification of filters.
13. Foundation Reactions: Static, Normal, Maximum.

Induction Motors
Installation
Equipment Data (continued)

Part 2
Sect. E

14. Shaft and keyway sizes with tolerances.
15. Location of grounding pad(s).
16. Bearing sizes and oil capacities.
17. Accessory wiring diagrams and terminal block schematics.

Additional General Information

18. Parts not supplied by Westinghouse:
 - a. Foundation bolts, couplings and coupling guards, lifting beams, slings or spreader bars, lubricating oil.
 - b. Hold-down bolts, dowels and sole plates (unless specifically stated on outline).
19. Bearings are not designed to take end-thrust unless specifically stated on outline drawing.
20. Bearings are insulated as specified on the outline drawing. Any metal connections to these must be insulated. A grounding strap is provided at the drive end when both ends are insulated. Bearing insulation should be checked with an ohmmeter or a Meggar before operating the motor. One bearing must be grounded while the motor is in operation. This is normally the drive end bearing for single shaft extension machines. On bracket type designs, the bearing at the end of the motor opposite the shaft extension end is insulated (see Figure 18). This insulation must not be short circuited. Also, any connections, such as a temperature detector, made to the insulated bearing must also be insulated from it.
21. Use a good quality of industrial type rust and oxidation inhibited mineral base lubricating oil with a viscosity of as specified on the outline drawing. Viscosity index should not be less than 95. The oil should be free from grit, inorganic acid, alkali, water, soap, resinous substances, and any other impurity which would interfere with the lubricating properties of the oil or be detrimental to the contacted surfaces.
22. Motor starting limitations as stated on the starting nameplate should be carefully observed.
23. Maximum load Wk^2 . If this motor is used to start load inertias greater than that stated on nameplate, heating will be excessive and may damage the rotor bars.

Induction Motors	
Installation	Part 2
Storage	Sect. F

STORAGE

General

If at all possible, the motor should be stored under cover in a clean, dry location.

If the storage location is cold and damp, or subject to severe humidity changes, the motor can be protected against condensation and moisture absorption by maintaining the temperature of the windings a few degrees above the ambient temperature. This can be done by energizing the space heaters or by placing several 100 or 150 watt electric lights inside the frame and connecting them to a power supply. Cover motor with tarpaulin to protect against construction dust; plastic covers are not recommended.

The effectiveness of storage protection can be checked by measuring insulation resistance at monthly intervals. A significant change in insulation resistance is usually indicative of moisture absorption and should be investigated. Refer to Inspection and Maintenance section of this leaflet.

During factory testing, motors with oil lubricated bearings are operated with a rust-inhibiting oil in the lubrication system. The oil is drained from the bearing reservoirs prior to shipment, but a protective film remains on the bearings and shaft journals. It is recommended that immediately on receipt, the bearing reservoirs be filled to the proper level with a rust-inhibiting oil. During the storage period, rotate the shaft several revolutions at monthly intervals. Check to see that the oil rings rotate and bring up oil to the journal by observing them through the sight window on the bearing cap. Note that often a shipping brace is attached to the shaft to prevent rotor motion during shipment. This brace must be removed before energizing the motor, or rotating the shaft, and must be replaced when moving the motor from storage to its final location.

Induction Motors
Installation
Storage (continued)

Part 2
Sect. F

Heating In Storage

The Thermalastic® Epoxy winding insulation has excellent inherent moisture resistance, but reasonable care should be exercised to protect the windings from excessive moisture whenever the motor is not operating. Such protection will also prevent rusting of the core and corrosion of metal parts not coated with slushing compound. The heaters should be energized whenever the storage area is cold and damp. It is not advisable to pass low voltage DC through stator or rotor windings to keep the motor warm.

Removal from Storage

Before a motor is started after being stored for an extended period of time it must be thoroughly inspected and cleaned. (See Part 4.)

The insulation resistance should be measured at this time in order to determine if it is within allowable limits.

Temporary Storage

Apparatus which cannot be installed as soon as received should be unpacked, examined, and stored in a room which is clean and dry and where temperature variations are small and slow.

Induction Motors	
Installation	
Warning - Unpacking	

Part 2
Sect. G

WARNING Open type motors may spark during operation around damaged squirrel cage windings, and in the event of failure may eject flame or molten metal. Therefore, consideration should be given to the avoidance or protection of flammable or combustible materials in this area of such motors.

WARNING Failure to observe the following may result in serious injury to personnel or damage the machine:

1. Installation and servicing of this motor should be performed only by trained personnel and in accordance with NEMA Safety Standard MG 2. High voltage and rotating parts can cause serious or fatal injury.
2. Before initiating maintenance procedures, disconnect all power sources to the machine and to the accessories (heaters, temperature detectors, etc.) to avoid electrical shock. Tag breakers, switches and control to prevent accidental usage by others.

Unpacking

Remove all packaging and any auxiliary heating devices that are not a permanent part of the motor. Clean the slushing compound from the shaft extension or coupling with a petroleum solvent observing required safety precautions. Inspect the motor and any auxiliary devices shipped separately for shipping damage -- refer to Receiving Section of this leaflet if damage is discovered.

Induction Motors
Installation
Procedure Before Installation

Part 2
Sect. H

PROCEDURE BEFORE INSTALLING

The installation of this motor requires great care and attention to detail, because subsequent successful performance of the machine will depend to a great extent on its alignment and rigidity with respect to the foundation. Before beginning to install the machine, the following points should be checked to avoid trouble once the operation has begun:

1. Check all items at the installation site against the manufacturer's shipping report. If all the equipment cannot be accounted for, the shortage should be reported at once to avoid undue delay. Likewise, any damaged equipment should be reported immediately.
2. Locate foundation bench marks to permit establishing the centerline of the unit and the elevation of the foundation surface.
3. Check the foundation against the outline drawing of the machine to be sure that any cable, conduit, bus, or ventilating ducts that may be indicated, have been provided in their proper locations and are of suitable dimensions to permit correct assembly of the unit and its accessory equipment.
4. Check the size, location, and elevation of the top of the foundation bolts against the outline drawing.
5. Make up a sufficient number of leveling plates and shims to make sure that the soleplate or bedplate will not be distorted when placed on the plates. These plates should be of steel approximately 1/4" by 4" and should be sawed or burned in lengths so they will extend about 2" beyond each flange of the soleplate or bedplate.

On large units, it is often advantageous to use a pair of tapered keys on the leveling plates for adjustment.

Induction Motors	
Installation	Part 2
Location	Sect. I

LOCATION

The location of the motor must be such that all requirements of the National Electric Code and all local codes and regulations are met. The following additional considerations should also govern the location:

1. Install the motor in a well ventilated area, not subject to ambient temperatures greater than 40°C (104°F) or elevation greater than 3,300 feet, unless higher ambient or elevation capability were specifically ordered.
2. Note the air inlet and outlet for the motor described herein, or on the outline drawing, and take the necessary precautions to prevent air recirculation from exhaust to inlet or hot discharge air from one motor directly entering the intake of another motor. Review Part 1, Sect. D, Ventilation Description.
3. Be sure that there is sufficient working space around the motor for disassembly, cleaning, inspection etc.
4. Sleeve bearing motors with oil ring lubrication must be mounted with the shaft in a horizontal position to prevent oil leakage and insure proper oil ring performance.
5. Special precautions should be taken where the installation environment is such that any sparks from the machine may cause any combustible to ignite.

Induction Motors	
Installation	Part 2
Foundation	Sect. J

FOUNDATION

A rigid foundation is essential so that vibration and misalignment during operation will be reduced to a minimum. The foundation preferably consists of solid concrete footings or piers of sufficient depth to rest on a solid sub-base. If it is necessary to support the motor on a steel structure instead of concrete, the beams or girders must be adequately braced and supported by columns. A common cause of motor vibration is the installation of the machine on high spacer rails without adequate design consideration. A competent consulting engineer, who is familiar with foundation design should design and supervise this part of the installation.

Refer to the outline drawing for all dimensions necessary for the foundation. A template made to the dimensions on the outline drawing will simplify the work of locating the foundation bolts. It is advisable to provide some adjustment in the location of the foundation bolts. This can be done by locating the bolts in steel pipe embedded in the foundation -- See Figure 3.

It is essential that the motor foot mounting surfaces rest on a steel pad or plate regardless of the type of foundation. The top surface of the steel pads or plates must form a level plane at an elevation slightly less than the maximum dimension from the motor shaft centerline to the mounting foot surface. This is necessary to allow addition of shims between the motor feet and steel mounting surface to obtain final alignment with the driven equipment. It is much easier to raise the motor with shims than to remove foundation if the final elevation is too high.

The top of the concrete foundation should be roughened, cleaned and washed before placing the bedplate or the soleplates upon it. A roughened surface permits a good bond between the foundation and any necessary grouting.

Induction Motors	
Installation	Part 2
Grouting	Sect. K

GROUTING

Grouting the Bedplate or Soleplates - See Figure 23.

Grout is mixed in the proportion of one part clean sand to one part Portland cement. Add water until the mixture is thin enough to be tamped thoroughly under the base. Rails or soleplates are grouted to within a half inch of the top. The entire operation of mixing and pouring the grout should be completed without interruption and as rapidly as possible. The benefit expected from a heavy solid foundation will not be realized if a poor job of grouting on the bedplate is done. The grout should fill all the spaces in the structural steel bedplates and should be carried flush with the top of the bedplate so that a solid tie between the bedplate and the roughened surface of the foundation is obtained.

Induction Motors	
Installation	Part 2
Foundation Mounting	Sect. L

FOUNDATION MOUNTING

The motor must be mounted such that the shaft is level. This is particularly important for motors with sleeve bearings as it prevents oil leakage along the shaft, allows proper operation of the oil ring, and allows the shaft to float freely in operation without thrusting against the bearing shoulders.

Shims should be made from steel stock as follows:

1. The shim should be at least as large as the width of the frame foot in both directions -- see outline drawing for foot mounting, or bearing surface dimensions.
2. The shims should be slotted to the proper depth to clear dowel guide holes and tapped jackscrew holes in the motor feet -- see outline drawing for hole location and sizes. This allows easy shim insertion or removal during alignment.
3. Shims must not have burrs on cut edges, particularly around the slots previously described to clear dowel and jackscrew holes, or on the outer shim edges, if they are the same dimension as the mounting band of the foot.

The recommended procedure for installing shims between the motor mounting foot surface and the steel foundation surface is:

1. Set the motor on the steel foundation surface approximately at its final aligned position. Be sure that hold-down bolts will go through the holes in the motor feet and properly engage threaded parts. Be certain that the shipping braces and their hardware (painted yellow) are removed.

Induction Motors	
Installation	Part 2
Foundation Mounting (continued)	Sect. L

2. Before making any vertical alignment changes, measure the gaps, if any, between all foot mounting surfaces and the steel foundation surface with feeler gauges to the smallest shim thickness available or to within .002 inch. Record the measurements, location, and depth of penetration of the feeler gauge from the outer side of each foot mounting band. Make an initial set of shims from these measurements of the required thickness with length equal to measured feeler penetration plus .5 inch. Insert each shim in the proper location and bend up the projecting edge against the side of the motor foot to permanently mark its depth position and facilitate handling of the shims.
3. After all initial shims have been made and installed, proceed with alignment adjustments of the motor, but keep the initial shims always at the same location and on top of any additional shims required.
4. Shims added to obtain final alignment should be the smallest possible number of thick shims rather than a large quantity of thin shims. A general guideline is that shim stacks of .06 inch or more should be replaced with a single shim of the same thickness.

The operational vibration performance of the motor is directly affected by the rigidity of the foundation and the degree of precision of its contact with the foundation.

Induction Motors	
Installation	Part 2
Alignment	Sect. M

ALIGNMENT

It is critical that the motor and load be **CORRECTLY ALIGNED** under actual operating temperatures and conditions. Machines which are correctly aligned at room temperature may become badly misaligned, due to deformation or different thermal growth, as they increase in temperature. The alignment must be checked and corrected, if necessary, after the motor and driven machine have reached their maximum temperature under load.

Adjust the position of the motor by shimming until the angular and offset alignment between the two shafts are within the following limits as measured with a dial indicator with the motor bolted down.

Angular misalignment:

0.002 inch TIR for coupling diameters up to 12"

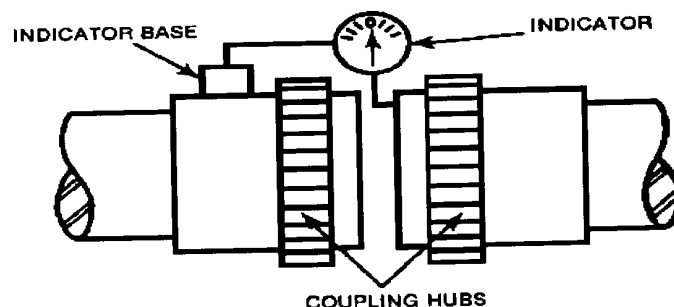
0.004 inch TIR for larger couplings

Offset misalignment:

0.002 inch TIR

TIR = Total Indicator Reading (by dial indicator)

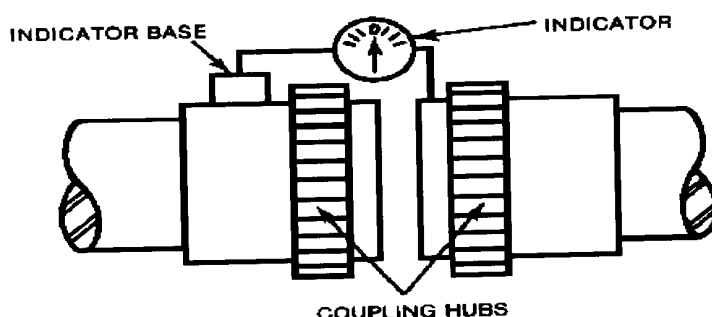
Angular misalignment is the amount by which the centerlines of driver and driven shafts are skewed. It can be measured using a dial indicator set up as shown below. The couplings are rotated together through 360 degrees so that the indicator does not measure runout of the coupling hub face. The shafts should be forced against either the in or out extreme of their end float while being rotated.



Induction Motors
Installation
Alignment (continued)

Part 2
Sect. M

Offset misalignment is the amount by which the centerlines of the driver and driven shafts are out of parallel. It can be measured using a dial indicator set up as shown below. Again, the couplings are rotated together through 360 degrees so that the indicator does not measure runout of the coupling hub outside diameter.



When adjusting the position of the motor, be sure that each foot of the motor is shimmed, before the motor is bolted down, so that no more than a .002" feeler gage can be inserted in the shim pack. A threaded bolt hole for vertical jacking is provided in each of the four motor feet for convenience in alignment. Jacking bolts must not be used as permanent supports.

The following factors must also be considered during the alignment process:

- A. The magnetic center of the rotor and the total motor endplay.

The magnetic center will be indicated by a permanently installed pointer which is factory aligned with the scribed mark on the shaft shoulder immediately outboard of the drive-end bearing. A nameplate giving the mechanical +/- endfloat dimensions is also provided. It is desirable in normal operation that the motor operate on its magnetic center, in which case no axial force is being exerted on the coupling.

Induction Motors	
Installation	Part 2
Alignment (continued)	Sect. M

- B. Increase in shaft centerline height due to thermal effects.

The initial (cold condition) alignment can be made on the assumption that the motor shaft height will increase from cold condition to full load condition as follows:

<u>Frame Series</u>	<u>Change in Shaft Height</u>
800	.009 inch

Any initial offset should be made on the basis of the different height change between the DRIVER and DRIVEN shafts. The final determination can only be made after the two units have come up to normal operating temperature and the hot alignment checked. Make a realignment if it is not within the above TIR limits.

After the alignment is completed, the equipment should be given a test run to verify that the lineup gives satisfactory performance. With the performance verified, the machines should be dowelled to their bedplate. Recommended dowelling is two dowels per machine, one in each of the diagonally opposite feet, with the size of the dowels approximately 1/2 the diameter of the hold down bolts. A pilot dowel hole for this purpose is located in each of the motor feet. These holes should be drilled and reamed together with the corresponding holes in the bedplate (or base) and the dowel pins inserted.

Machines which are correctly aligned when they are first installed may subsequently become misaligned due to wear, vibration, shifting of the base, settling of the foundations, thermal expansion and contraction or corrosion. Recheck the alignment periodically to correct for any changes.

It is recommended that "floating shaft couplings" or "spacer couplings" be used on motors where the coupling alignment cannot be accurately checked and/or maintained. Misalignment of several thousandths of an inch will result when there are relatively small changes in the temperature differences in large motors and driven equipment.

Induction Motors	
Installation	Part 2
Alignment (continued)	Sect. M

Axial Alignment and Air Gap Adjustment (Refer to Figure 21)

After the proper coupling alignment, shift the stator of the motor until the stator is in its proper axial position.

Adjust the vertical positions of the motor and exciter stators as necessary to make the air gap uniform around the stator bore by using shims under the stator feet. Usually, the maximum and minimum air gap measurements should not differ from average measured value by more than prescribed limit in the following table:

Nominal Air-Gap	Up to .060"	.061" to .100"	.101" to .200"	.201" to .500"	over .500"
Variation from Average Air-Gap	20%	15%	10%	5%	3%

See outline drawing and Figure 1 in Section 10 for specific limits.

It is particularly important that the air gap be uniform, for any inequality in the gap will cause unequal heating of the iron in the armature core. During these adjustments, the air gap should be gauged from both ends of the machine at four points around the rotor. The feeler gauge should be inserted between the poles in the motor and then moved over into the space between the pole face and the stator core. This procedure reduces the likelihood of reading too small a value for the air gap at a point near the end of the machine where a high punching is most likely to exist. File final measurements in Part 2, Section C of this book.

When the alignment of all parts is satisfactory, dowel the pedestals and frame to the base. Grout the bedplate or soleplates as instructed in the section on Grouting.

Induction Motors	
Installation	Part 2
Alignment (continued)	Sect. M

Realignment

If there is occasion to align the unit again after dismantling satisfactory alignment should be obtained by returning the machine to the positions indicating by the dowel holes. The thickness of the shims used should be the same as in the original erection. Nevertheless, the coupling alignment and air gap should be checked. The motor should be leveled before being put into operation.

Note To aid in the re-establishment of the correct air gaps when realignment is needed, file in Part 2, Section C, a record of the air gaps measured when originally installing this machine.

Induction Motors	
Electrical Connections & Start Up	Part 3
Connections	Sect. A

CONNECTIONS

Motor control wiring, overload protection and grounding should be done in accordance with the National Electrical Code and local requirements.

WARNING The motor frame should be properly grounded to protect personnel against danger from electrical shock. The ground connector should be bolted to the grounding pad, welded to the frame beside the frame foot. Unless otherwise specified, this is a stainless steel pad tapped to the standard NEMA size, .5-13 thread. The user should make sure that the pad is free of all paint before bolting the ground connector in place. See also NEMA MG2-3.15. Never install a motor with a standard enclosure where hazardous, inflammable, or combustible vapors or dusts present a possibility of explosion or fire which can cause damage to property or injury to personnel.

Refer to the outline drawing Figure 1 for the location of the main terminals and auxiliary terminal location and marking.

For three-phase motors with only three main leads, check to see if a single rotation directional arrow is mounted on the frame. If so, the motor has directional blowers and must be connected so that the shaft rotates in the specified direction. If a double rotation arrow or direction is found, the motor is capable of shaft rotation in either direction. Unless otherwise specified on the outline, phase sequence for mechanical rotation is L₁, L₂, L₃ connected to T₁, T₂, T₃ which produces clockwise rotation as viewed from the end opposite the shaft extension. For exact connection of motor leads for both low and high speeds, refer to connection nameplate mounted on motor. To change the direction of shaft rotation, interchange any two of the three power leads.

Note that motors with directional blowers can, in most instances, be changed to obtain shaft rotation in the opposite direction by switching the blowers end for end -- refer to the nearest Westinghouse Sales Office for assistance.

Induction Motors	
Electrical Connections & Start Up	Part 3
Connections (continued)	Sect. A

Before the power leads are connected to the motor, the insulation resistance of the winding should be measured to make certain it is suitable for operation. Refer to the Inspection and Maintenance Section of this leaflet for a description of the insulation resistance measurement, interpretation of the results, and corrective action.

CAUTION Before installing any terminals, carefully examine and clean all VPI resins from cable strands so that terminals and cables have a high quality of contact after terminal compression. If any leads (with or without terminals) are cut or shortened, examine and carefully clean cable strands of any VPI resin before applying any new terminals.

Before starting the motor, be sure that:

1. The power supply is of correct voltage, frequency and phase -- refer to the outline drawing or the rating nameplate on the motor.
2. The motor control equipment has been installed in accordance with its instructions.
3. Dis-connect space heaters.
4. Check out the electrical circuits; schematic diagrams can be found on the outline drawing.
5. Check the controls to make sure you can STOP the motor before you START it.

Induction Motors	
Electrical Connections & Start Up	Part 3
Initial Start - Uncoupled	Sect. B

INITIAL START - UNCOUPLED

Steps Prior to Initial Start

An initial start is considered to occur when the motor is first energized after initial installation, major maintenance, or extended shutdown. It is recommended that the initial start be made with the motor uncoupled from the load. The following checks must be made prior to the initial start:

1. Be sure that all installation or maintenance work is complete. Check the foundation bolts and dowels to be sure they are in place and tight.
2. Make sure that all shipping braces and protective coverings have been removed.
3. Check the bearings to ensure that all reservoirs are filled to the proper level with the correct lubricant. On flood lubricated machines, the oil reservoirs must be filled manually prior to an initial start. If an external lubrication system is used, be sure that it is filled to the proper level with the correct lubricant and is operative. Refer to the lubrication nameplate on the motor and the outline drawing for lubrication recommendations.
4. Measure the insulation resistance of the winding. If necessary, dry out the winding. Refer to the Inspection and Maintenance, Part 4 for instructions.
5. Do the voltage, number of phases, and frequency of the supply agree with those on the motor nameplate? Is the voltage within $\pm 10\%$ of the value on the rating nameplate?
6. If there is a direction of rotation nameplate on the motor; does the required direction of rotation agree with it? Fans with inclined blades on motors with directional rotation must be reversed if the direction of rotation is changed.

 Induction Motors

 Electrical Connections & Start Up

Part 3

 Initial Start - Uncoupled (continued)

Sect. B

7. Is there adequate space around the motor for proper ventilation?
8. Are all motor air inlet and outlet openings clear? Are all drain openings clear?
9. Has all construction dirt been removed from the motor? If compressed air is used to blow out the motor, the air must be clean and dry and not exceed 30 psi pressure.
10. Do all moving parts have sufficient clearance from all stationary parts?
11. Are there any foreign objects--wrenches, pliers, screwdrivers, tape, loose nuts or bolts, etc. in or on the motor? Remove them.
12. Is there any grating or rubbing noise while the motor is being turned by hand?
13. If the motor has current transformers, make sure the secondaries are either connected to the proper control equipment or shorted out. Never operate a motor with the current transformer secondary winding open circuited.
14. Inspect all electrical connections for correct termination, clearance, mechanical strength, and electrical continuity. If motor has been stored without heating for long time, check Part 4 for winding dry-out procedure.
15. Check connections to auxiliary motor equipment.
16. Check voltage and phases to space heater supply with that shown on the outline. Heater supply cables are connected to leads in a conduit box or to a terminal board as shown on the outline.
17. Identification of stator temperature detectors is given in the outline. Complete connection information is shown on the drawing supplied with the temperature measurement meter.
18. When surge capacitors and lightning arrestors are supplied in a motor connected cubicle or in the motor enclosure, connections are made at the factory. If any component is removed from the surge pak enclosure to make main terminal connection follow reinsulation instruction Figure 25. Check the control diagrams on other type installations.
19. Turn the rotor with suitable hand tools and be sure it rotates freely. Listen for any indication of rubs by the rotor against foreign objects in the air gap, or stationary parts while the rotor is turned and pushed in both directions to the limit of its end play. Also check the oil rings through the sight window to be sure they are turning.

Induction Motors	
Electrical Connections & Start Up	Part 3
Initial Start - Uncoupled (continued)	Sect. B

20. Push the rotor toward the driven equipment to the limit of the rotor end float. Check to be certain that the motor half coupling (with the proper bracing in place to support and center the shell of gear tooth type couplings) will clear the coupling half of the driven equipment in this position.

WARNING Do not attempt an uncoupled start if coupling interference cannot be remedied.

21. Check the air gap at both ends with feeler gauges. Refer to Inspection and Maintenance, Part 4, for detailed instructions on air gap measurements and tolerances. It is recommended that the air gap readings be recorded at the time of initial installation and retained for comparison with any future air gap readings. If the air gap is outside the allowable tolerance, contact the nearest Westinghouse Service Engineer.
22. Replace all covers and other pieces removed for inspection purposes. Check to be sure that all covers, screens, and filters are in place.
23. Be certain that all protective devices and all monitoring equipment are connected to function properly.
24. Ensure that all personnel are safely clear of the rotating parts. Close the main breakers.
25. Bump the motor electrically (push the start control button and immediately push the stop control button) to check for the correct direction of shaft rotation. Be sure that directional motors rotate in the proper direction for the driven equipment. Motors with directional rotation arrows must be operated in the indicated direction in order to ventilate properly.
26. After the rotor has coasted to a standstill, de-energize the power supply and make any necessary power lead connection changes required to correct the direction of rotation. Reinsulate any changed connections.

Induction Motors

Electrical Connections & Start Up

Part 3

Initial Start - Uncoupled (continued)

Sect. B

27. Re-start the motor and allow to run. Check the bearing temperature frequently, especially during the first two hours of operation. In this period of time, the rate of bearing temperature rise is more indicative of trouble than the absolute bearing temperature. If the rate of bearing temperature rise appears excessive, shut the machine down and inspect the bearings. The final total bearing temperature should not exceed 90°C (194°F) or 50°C rise over ambient air temperature for self cooled bearings when measured by bearing temperature detectors. Refer to the Inspection and Maintenance Section for instructions concerning bearing inspection and thermometer measurements.
28. It is recommended that records be kept of the steady state uncoupled vibration and bearing temperatures to use for comparison with coupled and loaded running conditions, and to provide a data base to judge the machine's performance in the future. These records should be filed in Part 2, Section C of this book.

Induction Motors	
Electrical Connections & Start Up	Part 3
Initial Start - Coupled To Load	Sect. C

INITIAL START - COUPLED TO LOAD

1. Remove any bracing used to support and center the coupling shell. Lubricate and assemble the coupling halves in accordance with the coupling manufacturer's instructions. Note any match marks on the couplings and be sure to assemble according to match marks, if they exist.
2. Ensure that all personnel are at a safe distance from rotating parts. Start the motor in accordance with instructions supplied with the motor control.
3. If the motor rotor fails to start turning in a second or two, shut off the power supply immediately. This can result from:
 - a. Too low a voltage at the motor terminals.
 - b. The load is too much for the rotor to accelerate.
 - c. The load is frozen up mechanically.
 - d. All electrical connections not made.
 - e. Any combination of the above.Investigate thoroughly and take corrective action before attempting any restart.
4. If the motor fails to reach full speed and is running at a reduced speed for more than a few seconds, shut off the power supply immediately. This can result from:
 - a. Too low a voltage at the motor terminals.
 - b. Load torque at the hangup speed equals maximum motor torque at that speed.
 - c. A combination of the above two causes.Investigate thoroughly and take corrective action before attempting any restart.
5. Note that motor vibration may not be identical to uncoupled values. If coupled vibration is excessive, recheck the mounting and alignment- see also Trouble Shooting, Part 9.

Induction Motors	
Electrical Connections & Start Up	Part 3
Initial Start - Coupled To Load (continued)	Sect. C

Routine Starts

Make routine starts following the regular sequence of operations given in the motor control instructions. It is recommended that a routine check of motor operation as described in the preceding section, Initial Start - Uncoupled, be made immediately after each routine start. Do not exceed the limits of starting duty stated on the starting limit nameplate described in the next section, or the temperature limits stamped on the rating nameplate.

Starting Duty

WARNING Too frequent starting may result in serious injury to the motor windings or rotor. To prevent such damage, the maximum starting duty as stated on the motor nameplate should not be exceeded.

Motors will have a metal starting duty nameplate attached to the motor frame. Comply with the starting limitations stamped on this nameplate. It is recommended that the starting limitations be copied from the nameplate and filed with control and operating instructions.

CAUTION Repeated starts and/or jogs greatly reduce the life of the windings or the rotor due to the high forces and heating.

Induction Motors	
Electrical Connections & Start Up	Part 3
Inactivation	Sect. D

INACTIVATION

On Site

If the machine is taken out of service for a time period greater than one month, but will be left on the foundation coupled to the driven equipment, the following is recommended:

1. Drain the oil and replace with clean rust-inhibiting oil. Rotate the shaft several complete revolutions at monthly intervals or more frequently if the location is damp and subject to temperature changes that produce condensation.
2. Energize the space heaters and check periodically to be sure they are working.
3. Coat all bare metal surfaces of outdoor installations with a rust protective coating.
4. Be sure to tag all control and power equipment for the motor with warning tags indicating what was done and what is required before any start can be made.
5. To reactivate the motor, clean off the external rust protective coating, drain and refill the bearing sumps with clean service oil, remove any auxiliary heating devices installed within the motor frame and go through Steps Prior to Initial Start in a prior section of this part.

Off Site Storage

If the motor is removed from its location, to be stored elsewhere for a time period greater than one month, the following is recommended:

1. Coat all bare metal surfaces with a rust protective coating.

Induction Motors	
Electrical Connections & Start Up	Part 3
Inactivation (continued)	Sect. D

2. Locate the original shipping braces and install them. If the original braces cannot be found, fabricate a brace for the motor on the principle that the brace must pull the rotor to one extreme position of its total end float and hold the rotor there during the jolts it will experience in handling and transit.
3. Store the motor as described in Part 2, Sect. F of this manual.
4. Reactivate the motor as described in prior sections of this manual.

Note If machine was originally shipped disassembled, provision must be made to properly store individual components.

Induction Motors	
Inspection and Maintenance	Part 4
Introduction	Sect. A

INTRODUCTION

WARNING To avoid personal injury and before servicing machine or touching any internal parts, all power sources to the machine and its auxiliaries should be disconnected and deenergized. All rotating parts should be at standstill. Frame of machine must be grounded properly to avoid severe injury to personnel. Installation and servicing of this electrical machine should be performed only by trained personnel in accordance with National Electric Code, all local codes, NEMA Safety Standard MG 2, and after reading Westinghouse Instruction Book furnished with the machine. See outline drawing for special assembly instructions and locating of lifting points and special handling instructions. Lifting eyes mounted on individual parts are for lifting the individual part only. Lifting slings must not put undue side thrust on lifting eyes.

To insure continuous service, it is necessary that an inspection and maintenance program be initiated that will detect malfunctions before they become major problems. The following suggestions are guidelines to establishing an effective preventive maintenance program.

Note Further detailed information on maintenance practices is provided in the publication "Maintenance Hints" available through your local Westinghouse sales office.

Instructions and procedures necessary to ensure continued, satisfactory operation of the motor are given in this part. Whenever the detailed nature of a motor component or assembly requires it, the reader is referred to appropriate illustrations. Instructions for disassembly may be followed no matter which step of motor maintenance the user may conduct.

Induction Motors	
Inspection and Maintenance	Part 4
Introduction (continued)	Sect. A

Routine Inspection of Operating Motors

Westinghouse recommends that the lubrication system be inspected frequently. The oil level in all gauges should be checked. Rotation of the oil rings should be checked by looking through the oil ring inspection gauge. If any oil leakage is noted, it should be traced to the source and corrected. Watch for lubricating oil discoloration or contamination. Note any suddenly developed or excessive noise or vibration and correct it quickly. Check the bearing temperatures periodically, at least once a week during continuous operation.

Induction Motors	
Inspection and Maintenance	Part 4
Service Tools	Sect. B

SERVICE TOOLS

A complete set of tools should be made available for installation and maintenance. Standard tools and parts needed for securing the motor, making adjustments and carrying out normal maintenance are:

- a. Slings and ropes and a crane to handle the heaviest pieces.
- b. Alignment dial gauges, feeler gauges for adjusting couplings and air gaps.
- c. Jacks for small movements.
- d. Protecting and enclosing tarpaulins.
- e. Bearing puller (anti-friction bearings).
- f. Flashlight.
- g. Lint-free cloths.
- h. Vacuum cleaner.
- i. Compressed dry air (30 psi gauge maximum).
- j. Barring lever.
- k. 500 or 1000 V "Megger" and high voltage voltmeter.
- l. Volt-ohmmeter.
- m. Foundation and holding down bolts.
- n. Bearing oil of recommended type.
- o. Recommended solvents.
- p. Metric Allen type wrenches when spherical seat bearings are supplied see Sect. 5.
- q. Torque wrench with sockets.
- r. A suitable fire extinguisher (preferably the CO₂ type).

Induction Motors	
Inspection and Maintenance	Part 4
Periodic Inspection and Checks	Sect. C

PERIODIC INSPECTION AND CHECKS

Depending on service conditions, the machine should be inspected annually or semi-annually. Unusual service conditions that warrant semi-annual inspections are:

1. Exposure to:
 - a. Abrasive, or electrically conducting dusts.
 - b. Lint or very dirty operating conditions where the accumulation of dirt will interfere with normal ventilation.
 - c. Chemical fumes, steam, salt laden air, or oil vapor.
 - d. Damp or very dry locations, radiant heat, vermin infestation or atmospheres conducive to the growth of fungus.
 - e. Abnormal shock, vibration, or mechanical loading from external sources.
2. Operation where:
 - a. There is excessive departure from rated voltage and/or frequency (see NEMA MG2-3.06).
 - b. The room is poorly ventilated or ambient air temperature exceeds the value stamped on the nameplate.
 - c. The machine is subjected to torsional impact loads, repetitive overloads, electric reversing or braking, or long accelerating times due to high load inertia.

Checklist

The following inspection checklist is recommended:

1. Drain, flush, and re-lubricate the bearings. Inspect the bearings and lubrication system if any unusual conditions have been previously noted. See Bearing Section Part 5 for inspection procedures and outline drawing for lubrication recommendations.
2. Make corrective action for oil leakage around the bearing seals.

Induction Motors	
Inspection and Maintenance	Part 4
Periodic Inspection and Checks (continued)	Sect. C

3. Remove the end covers and top enclosure. Look for evidence of condensation or water accumulation, rust, or corrosion.
4. Note the accumulation of dirt or other foreign material. Remove general dirt and dust as described in the Part 4, Section F. Refer to Part 4, Section D for specific recommendations about cleaning windings.
5. Look for signs of overheating of components, particularly insulation, as evidenced by blistering, discoloration, or charring. Inspect all insulated electrical connections for frayed or damaged insulation, cracked varnish or coil movement. Measure the stator winding insulation resistance as described in Part 4, Section E.
6. Check all uninsulated electrical connections for tightness. Look for evidence of overheating, arcing, or corrosion. Take remedial action as required.
7. Inspect all nuts and bolts to be sure they are tight. This is particularly important for fasteners on the rotor or fasteners that could fall into the rotor if loosened.
8. Check the coupling lubricant if applicable. Refer to instructions supplied with the coupling.
9. Check main lead terminal connections for heating and any signs of corona.

A record should be kept of the dates and conditions observed during periodic inspections. The record should include all insulation resistance data, any adjustments or repairs made, and any lubrication additions or adjustments made. These records will provide useful reference for any future inspections. It is recommended that these records be filed in the place provided in Part 2, Section C of this book.

Induction Motors	
Inspection and Maintenance	Part 4
Inspection and Cleaning of Windings	Sect. D

INSPECTION AND CLEANING OF WINDINGS

The motor windings can be easily inspected upon removal of the end covers and airshields, if supplied. See Figure 2.

In order to completely inspect and clean the windings, it is necessary to remove the rotor from the stator, except with units having stator shift.

Any one of several methods may be utilized to clean the windings; the most effective method depends upon the kind and amount of dirt lodged on the windings. The methods which may be used are listed below in order of preference.

Note Before cleaning the windings, inspect them for loose wedges or spacers, evidence of damage to insulation, distortion or movement of coils, etc. If these conditions are present, contact local Westinghouse Service Engineers for recommendations.

Dry-Wiping

Cleaning by wiping with a clean, dry, lintless cloth may be satisfactory when the surfaces to be cleaned are accessible and when only dry dirt is to be removed. "Waste" should not be used because lint will adhere to the insulation and increase dirt collection. Lint is particularly objectionable on high-voltage insulation as it tends to cause concentration of corona discharge.

Brushing and Suction Cleaning

Dry dust and dirt may be removed by brushing with bristle brushes, followed by vacuum suction cleaning. (Do not use wire brushes.) This is a desirable method because the dirt is not scattered and does not settle on other apparatus.

Induction Motors	
Inspection and Maintenance	
Inspection and Cleaning of Windings (continued)	

Part 4
Sect. D

Blowing

Blowing out dirt with a jet of air should be done only to remove dirt from almost inaccessible crevices and only when the motor is dry. Avoid directing the air in such a way that the dirt will be blown into inner recesses from which it would be difficult to remove and where it might clog vent ducts.

CAUTION Do not use air pressures greater than 30 psi in order to avoid damaging the insulation and so that dirt will not be blown under loosened insulation. Be certain that the air is dry and does not contain water from condensation in the air lines.

Solvent Cleaning

CAUTION Solvents should never be used on windings with Class H (silicone) insulation. See nameplate for type of insulation.) Refer to Water, Emulsion, and Alkali Cleaning for the proper method of cleaning silicone insulation.

Solvent cleaning is particularly effective for removing tar, grease, wax, and oil from electrical apparatus. The surfaces can be wiped with a cloth wetted with the solvent, followed by wiping with a dry cloth. ("Waste" should not be used in order to avoid depositing lint on the insulation.) The solvent may be hosed on if necessary.

Westinghouse recommends that solvents such as Stoddard solvent, mineral spirits, or comparable petroleum solvents be used for cleaning insulation whenever possible. In fire-hazardous areas, inhibited methyl chloroform may be used. While this solvent is not flammable under ordinary conditions, it is moderately toxic. Therefore, local exhaust ventilation is necessary if the odor of solvent vapors is very noticeable.

Induction Motors	
Inspection and Maintenance	Part 4
Inspection and Cleaning of Windings (continued)	Sect. D

WARNING When working with solvents, always provide adequate ventilation in order to avoid fire, explosion, and health hazards. In confined areas (such as tanks or pits), provide each operator with an air-line respirator, a hose mask, or selfcontained (air) breathing equipment. The operators should also wear goggles, neoprene aprons, and suitable gloves. Solvents should always be stored in safety cans. Always keep open flames and sparks from flammable solvents and their vapors.

Do not use solvents on windings with elastomeric coating for abrasive conditions.

Water, Emulsion, and Alkali Cleaning

Motors may be cleaned by hose washing or by pressure spray from a steam generator. Steam from a shop line or a spray of hot water and compressed air may be used. The jet pressure and temperature should not exceed 30 psi and 80°C (176°F), respectively, when cleaning insulation.

It is necessary to add a nonconductive detergent compound to the water for removal of tar, wax, grease, or oil from insulation. These compounds contain non-ionic emulsifying agents. Some known as emulsion cleaners, also contain solvents to soften the hard deposits so that they can be more easily washed off. These compounds are not electrical conductors and are safe on insulation.

CAUTION Windings with Class H (silicone) insulation should be cleaned only with water and a non-conductive detergent such as Dreft (or equivalent).

Induction Motors	
Inspection and Maintenance	Part 4
Inspection and Cleaning of Windings (continued)	Sect. D

Shell Blasting

Air blasting with ground nut shells to remove hard dirt deposits from insulation may abrade the insulation and should not be done except under the supervision of Westinghouse Field Service Engineers.

Use only mild abrasives such as 12-20 mesh ground walnut shells (Westinghouse pellets 22304BF). The operator should direct the jet of abrasive at a small area long enough to remove the dirt without damaging the insulation. Canopies or other shielding should be erected to prevent unnecessary contamination of other equipment or areas.

Note If the insulation shows signs of dryness, clean and revarnish the windings, preferably under the guidance of Westinghouse Field Service Engineers.

Induction Motors	
Inspection and Maintenance	Part 4
Insulation Resistance	Sect. E

INSULATION RESISTANCE

Insulation resistance (of a winding) is defined as the resistance of insulation to a DC voltage which tends to produce leakage currents through the insulation and over its surfaces. The original insulation resistance is lowered by such factors as aging, mechanical damage, dirt, moisture, increased temperature, increasing the test voltage or by decreasing the time of application of test voltage.

The stator winding insulation resistance should be measured before applying operating voltage if:

- A. The windings have been cleaned.
- B. The motor has undergone major service or repair.
- C. The motor has been idle or for an extended period, either in or out of storage.
- D. The motor may have been exposed to moisture.
- E. There is reason to suspect the insulation quality has been compromised.

In addition, it is recommended that stator insulation resistance measurements be taken approximately every year and compared with earlier measurements.

WARNING Use care when measuring insulation resistance. Contact with high-voltage electrical current may be fatal. Ground winding before and after testing to drain off all charging voltage. The grounding time should be a minimum of four times the charging time.

The insulation resistance should preferably be measured at ambient temperature with either a motor driven or a Rectox-type megger. The test voltage should be applied between the entire winding (all winding leads connected together) and ground for approximately one minute with the winding at ambient temperature. The DC test voltages used should never exceed the motor operating voltage.

Induction Motors
Inspection and Maintenance
Insulation Resistance (continued)

Part 4
Sect. E

Preferred Method of Measuring Insulation Resistance

If facilities are available, Westinghouse recommends that any of the instruments mentioned above be used to measure the insulation resistance over a period of ten or fifteen minutes at a potential near the operating voltage. Readings should be taken every fifteen seconds for the first two minutes, and then every minute during the remainder of the test.

The recommended DC test voltages, based on motor operating voltages, are as follows:

Motor Operating Voltage	DC Test Voltage
up to 900 V	500 VDC
901 to 7000 V	1000 VDC
7001 and higher	2500 VDC

The recommended minimum insulation resistance is determined as follows:

$$R_M = Kv + 1$$

R_M = Recommended minimum insulation resistance in megohms at 40°C (104°F) of the entire winding

KV = Rated motor terminal to terminal voltage — kilovolts (1000 V = 1 Kv)

On a new winding, where the contaminant causing low insulation resistance is generally moisture, drying the winding through the proper application of heat will normally increase the insulation resistance to an acceptable level. The following are accepted methods of applying heat to a winding:

- A. The space heaters can be energized to heat the winding.

Induction Motors	
Inspection and Maintenance	Part 4
Insulation Resistance (continued)	Sect. E

- B. Heated air can be either blown directly into the motor or into a temporary enclosure surrounding the motor. The source of heated air should preferably be electrical as opposed to fueled (such as kerosene) where a malfunction of the fuel burner could result in carbon entering the motor. Caution must be exercised when heating the motor with any source of heat other than self contained space heaters. The winding temperature must rise at a gradual rate to allow any entrapped moisture to vaporize and escape without rupturing the insulation. The entire heating cycle should extend over 15-20 hours.

Insulation resistance measurements can be made while the winding is being heated. However, they must be corrected to 40°C for evaluation since the actual insulation resistance will decrease with increasing temperature. The equivalent resistance may be calculated with the following formula:

$$R_{40^{\circ}\text{C}} = K_{t40^{\circ}\text{C}} \times R_t$$

$$R_{40^{\circ}\text{C}} = \text{unknown insulation resistance in megohms at } 40^{\circ}\text{C}$$

$$R_t = \text{Insulation resistance in megohms at temperature } t$$

$$K_{t40^{\circ}\text{C}} = \text{approx. resistance temp. coefficient (Figure A) for temperature } t.$$

Induction Motors
Inspection and Maintenance
Insulation Resistance (continued)

Part 4
Sect. E

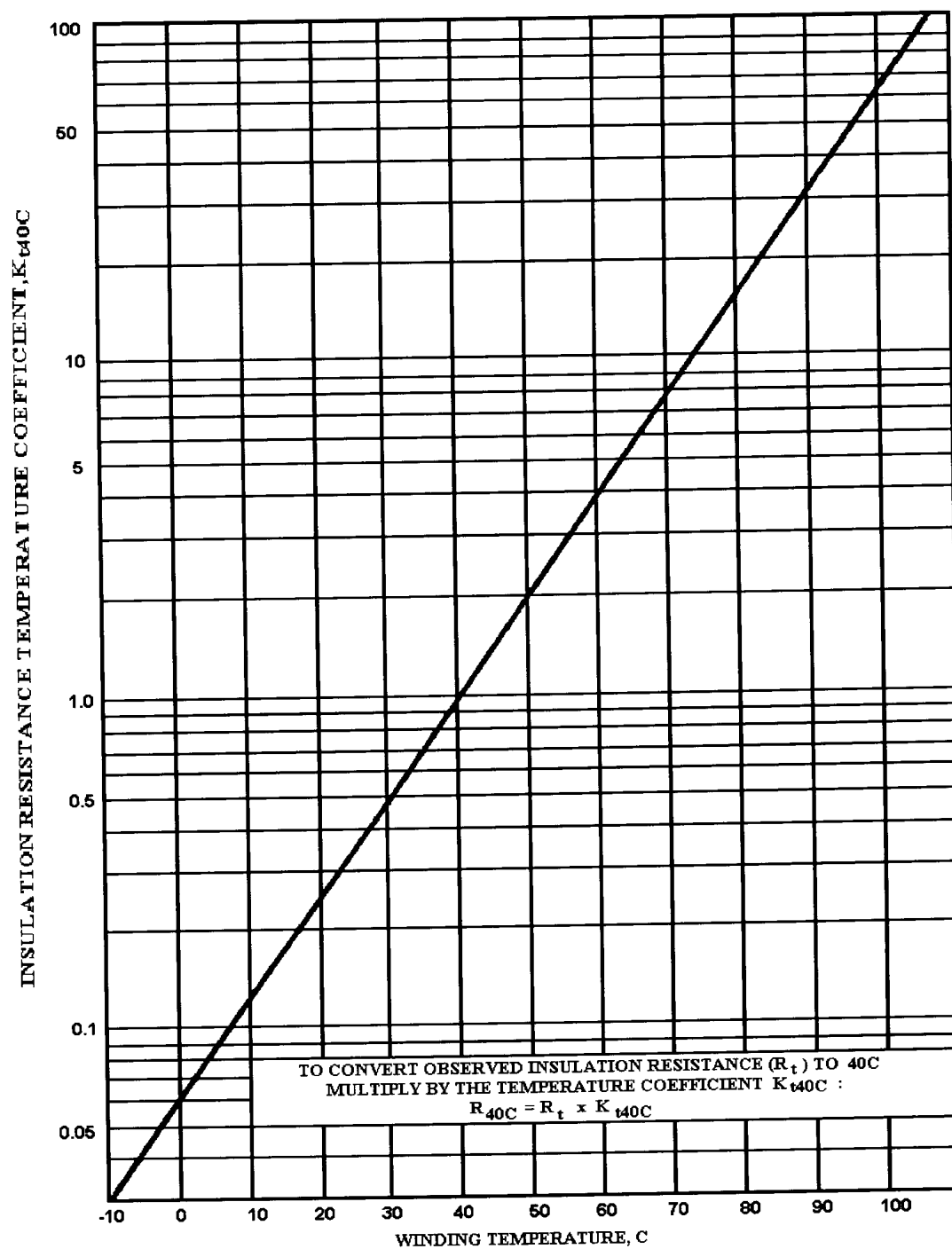


Figure A. Approximate Insulation Variation with Temperature

Induction Motors	
Inspection and Maintenance	Part 4
Insulation Resistance (continued)	Sect. E

Alternate Method of Recording and Evaluating Insulation Resistance — If the test voltage is applied for a period of ten minutes while taking periodic resistance readings, a graph of resistance value variation with time can be plotted on a log-log chart. The data should be recorded every 15 minutes for the first minute, every 30 seconds for the second minute, and at one minute increments during the remaining eight minutes. The rate of rise of this curve represents the dielectric absorption characteristic. A steadily rising curve is indicative of a clean, dry winding, while a quick flattening curve is the result of leakage current through or over the surface of the winding insulation, and is generally indicative of a moist or dirty winding. Typical curves are shown in Figure B.

The data obtained can also be used to determine the polarization index by taking the ratio of the insulation resistance reading at ten minutes to the reading at one minute. The polarization index may be considered as a means of expressing the shape of the dielectric absorption characteristic curve in terms of a single numerical quantity. See Figure B. A rising curve tends to increase the polarization index while a flat curve tends to lower it. The polarization index is useful in appraising the dryness of the insulation and suitability for over-potential tests. It is not affected by temperature when the machine temperature is constant or changing very slowly. The recommended minimum value of the polarization index for alternating current motors is 2.0 for both Class B and F insulation systems.

Induction Motors

 Inspection and Maintenance

 Insulation Resistance (continued)

Part 4
 Sect. E

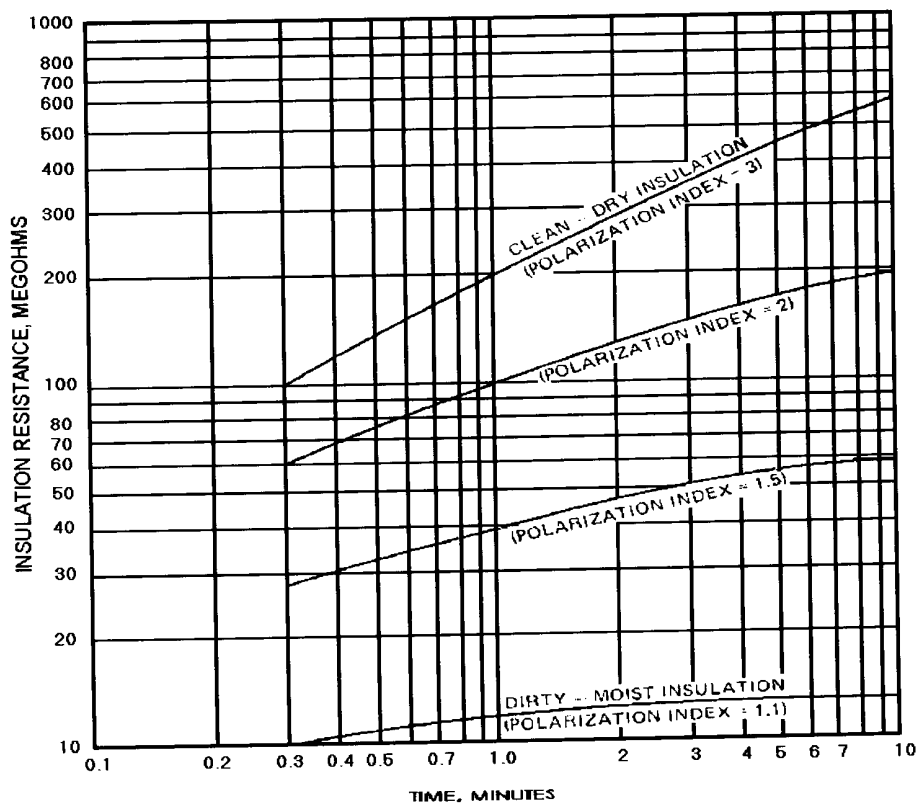


Figure B. Typical Variation of Insulation Resistance With Time

Suitability for Overpotential Tests

Machines rated 10,000 KVA and less are considered to be in suitable condition for overpotential tests if either the polarization index or the insulation resistance equal or exceed the minimum recommended values.

Machines rated above 10,000 KVA should have both the polarization index and the insulation resistance above the minimum recommended values.

Induction Motors	
Inspection and Maintenance	Part 4
Insulation Resistance (continued)	Sect. E

Remedial Action

Should the insulation resistance of the motor be less than that given by the formula, proceed as follows (measure the insulation resistance after each step):

1. Visually inspect windings and clean them if it is thought necessary. (Cleaning methods are described in prior sections of this part).
2. Separate the phases, if possible, so that their respective values of insulation resistance may be compared. This step is especially important if an abnormally low value of insulation resistance is obtained for the entire winding.

Note The insulation resistance of one phase of a three-phase motor with the other two phases grounded, is approximately 2 times that of the entire winding.

3. If the values of insulation resistance obtained for the individual phases are of approximately the same magnitude and if the surfaces are relatively clean, make sure the winding is dry.
4. If the steps described above do not remedy the low value of insulation resistance, the trouble probably is due to the ground wall (the portion of the insulation which is in contact with the motor frame). One may determine whether such is the case by the following check:

Probe of End-Turn Portions - A probe of the end-turn portions of the winding may localize the trouble, but such a procedure is time-consuming and not always effective.

Should the trouble be confined to the ground wall insulation, call the local Westinghouse Field Service Engineers for assistance.

Induction Motors	
Inspection and Maintenance	Part 4
Disassembly of Motor	Sect. F

DISASSEMBLY OF MOTOR

Note It is recommended that any procedure of disassembly be written down in sequential form for reference in reassembly. The following is a general procedure. For more detailed instructions of bearing disassembly refer to Part 5, Section D.

1. Refer to outline drawing Figure 1 and Cross-Section drawing Fig. 2.
2. Turn off power to motor and accessories by opening disconnect switches (and/or circuit breakers). Tag these switches to prevent their being closed by careless personnel. Disconnect all conduit and conduit connections from the motor, bearings, and exciter.
3. Remove end covers and side covers and top enclosure. The ventilation enclosure is bolted to the frame and stator assembly with four bolts. To remove the ventilation enclosure, unbolt and remove the four covers. Remove the four bolts attaching the enclosure to the frame. Before lifting the enclosure, check to see if any wires from protective devices mounted in the enclosure remain to be disconnected. Disconnect any lead wires at the terminal blocks provided. Remove the ventilation enclosure horizontally or vertically as space requirements dictate.
4. Remove air shields if supplied (at both ends of the motor).
5. Remove top halves of bearings by lifting them off after taking out holding bolts. Then remove oil rings. Note that these rings consist of two half-rings fastened together with small screws. Remove these screws and carefully lift oil rings out of bearings. Refer to Part 5.
6. On motors with forced-flood lubrication systems, open the pipe couplings, flanges, and adapters at each end of motor.
7. Uncouple motor from mechanical load in accordance with instructions supplied with coupling. Insert sheet liner in lower half of motor air gap before rotor is rested inside stator bore.

Induction Motors
Inspection and Maintenance
Disassembly of Motor (continued)

Part 4
Sect. F

8. If crane will support frame and stator, and rotor, and both are to be moved, attach lifting hooks to stator lifting lugs. Carefully lift stator assembly (with rotor resting in stator bore) straight up so that assembly clears the foundation. Move stator assembly to convenient storage or work area.
9. Remove all thermostats, thermocouples, etc., from bearings.
10. On motors with sleeve-type bearings, roll out and remove bottom halves of the bearings by lifting the rotor with a jack. Remove the bearing brackets. Refer to Section 5 for details.
11. The motor has now been completely disassembled (except for the removal of the rotor from the stator bore).

Removing Rotor from Stator

Be sure there is sufficient room around the assembly of stator and rotor, to remove rotor. Protect the shaft journals and adjacent seal areas with heavy wrappings of Kraft paper.

1. Fit a steel pipe of suitable inside diameter, length and strength over the end of the rotor opposite the coupling. Do not place the pipe over the journal, but locate it instead over the portion of the shaft adjacent to the rotor core.
2. Attach lifting slings to the steel pipe and to the portion of the shaft adjacent to the coupling.
3. Carefully lift the rotor until it is nearly centered in the air gap. Slowly move the rotor axially out of the stator towards the coupling end. Use extreme care not to slide or scrape the rotor against the stator bore or the stator winding.
4. When the rotor core and fans have passed through the stator bore and are clear of the frame end, attach a third sling around the shaft or rotor core at the end opposite the coupling end and adjust the third sling to carry the weight previously supported by the steel pipe.
5. Remove the steel pipe and sling attached to it taking care not to bump or damage the stator windings.

Induction Motors	
Inspection and Maintenance	Part 4
Disassembly of Motor (continued)	Sect. F

6. Remove the rotor from the stator bore and set it on a large sheet of thick cardboard or other suitable material at a convenient location. Block the rotor in place.

The rotor and stator interior are now available for detailed inspection and maintenance.

General Motor Cleaning

The interior and exterior of the machine should be kept free from dirt, oil, and grease. Oil vapor, product, fly ash, chemicals or textile dust can build up and block off ventilation resulting in overheating of the windings. Conducting dusts shorten insulation creepage distances. Sharp dusts driven by the rotor fans or vents tend to abrade the stator insulation and shorten its useful life. Magnetic dust is a particular hazard to insulation because of the magnetic properties and the agitation by magnetic fields.

Light and relatively harmless dust can be blown out with low pressure dry air - 30 psi or less. Grit, metallic, magnetic, or carbon dust should be removed by suction with non-metallic suction tips.

Cleaning of Air Filters

Remove the filters from their holders. Reuseable filters may be cleaned by hosing the fine-mesh side with hot water, if the filter adhesive is of the water-soluble type, or by agitation (fine-mesh face down) in a solution of Oakite No. 20 (3 pounds to 5 gallons of water), trisodium phosphate (1 1/2 pounds to 5 gallons of water), or other suitable cleaning compounds. Never use caustic soda or other strong alkalies. If more convenient, the filter may be boiled (fine-mesh face down) for five minutes in one of the cleaning solutions mentioned. After cleaning, look through the filter toward a bright light; no cloudy areas will be seen if the filter has been thoroughly cleaned. It is not necessary to wash the blackened oil coating from the wire.

Induction Motors	
Inspection and Maintenance	Part 4
Disassembly of Motor (continued)	Sect. F

Before the air filters are replaced, they must be properly charged with the correct adhesive; commercial adhesives (such as Air-Maze Filterkote) or SAE 30-50 motor oil may be used for this purpose. Charging may be accomplished by dipping the filter in the adhesive, spraying it thoroughly with a power-spray gun, or by liberally coating both sides by means of a brush. After charging, allow the filters to drain thoroughly face down or on edge over a suitable receptacle. When excess adhesive has drained off, replace the filters and filter access covers.

Induction Motors	
Inspection and Maintenance	Part 4
Reassembly of Motor	Sect. G

REASSEMBLY OF MOTOR

Assemble the rotor, bearing brackets, and bearings in the reverse order as described in Disassembly. When assembling the oil ring and seals, refer to Section 5.

CAUTION There should be no screws or dowels extending beyond the sides of the oil ring. The splits of the ring must be smooth on the sides as well as in the bore. All burrs must be removed. Rings must be handled carefully to prevent bending or damage at the splits.

Clean the parting surfaces of the bearing bracket and cap and spread a thin coat of sealer Permatex #2 or equivalent before assembling the cap.

Finish assembly of the motor in the reverse order as described in Disassembly.

Induction Motors	
Bracket Bearings, Spherical Seat Self-Aligning	
Introduction	

Part 5
Sect. A

INTRODUCTION

This part is intended to convey the proper understanding of the construction and operation of the bearings and lubrication systems used. It also provides the information necessary for the repair or replacement of bearings and specifies the type and method of lubrication to be used.

The strict adherence to the guidelines and recommendations advanced here will result in maximum bearing life and minimize motor downtime.

Induction Motors	
Bracket Bearings, Spherical Seat Self-Aligning	Part 5
Description	Sect. B

DESCRIPTION

CAUTION All threaded fasteners in the bearing and housing are metric and are sometimes very close in dimension to familiar customary items in the inch system. During any maintenance procedure, replacement items must have the same measurements and strength as those removed, whether metric or customary. Mismatched or incorrect items can result in damage or malfunction, or possible personal injury. All pipe threads intended for customer use are NPT.

Description of Components

The sleeve bearing and its housing (see Fig. 18M) are split horizontally so that the bearing can be easily removed without removing the rotor or coupling. The two bearing halves are held in alignment by two dowels in the mating surfaces. The bearing is spherically seated in the housing and is held in place by the bearing cap. Bearing rotation is prevented by a pin projecting from the top of the bearing housing cap.

The bearing shell is steel with babbitt in the bore. The rear bearing has babbitt lined thrust faces to limit end float when the machine is run uncoupled. These faces are not intended to carry any significant thrust load. Use of a limited end float coupling is required.

In general, the bearing at the end opposite the shaft extension is insulated to prevent the flow of bearing currents that produce pitting of the babbitt. Any connections, such as a temperature detector, made to the insulated bearing must also be insulated from it. When temperature measuring devices are supplied, the sensitive portion of the instrument fits into a drilled hole in the bearing shell very close to the babbitt lining.

When an insulated bearing is supplied, the housing spherical seat and bearing anti-rotation pin are insulated.

The housing is attached to the bearing bracket by five bolts and two locating dowels. There may be shims between the housing and bracket, these are selected at the factory and should not be disturbed.

Induction Motors	
Bracket Bearings, Spherical Seat Self-Aligning	Part 5
Description (continued)	Sect. B

The bearing bracket is attached to the frame with six or eight bolts and is located by two dowels. There are covered holes on either side of the vertical center line that can be used to attach lifting shackles.

It is not normally required to remove the housing from the bracket. This should only be done when the housing or bracket is damaged and must be repaired or replaced.

Outer seals are available for many types of protection (Fig. 27M). The standard outer seal is the floating labyrinth. This seal has a cast iron seal carrier that bolts to the housing. The design of the carrier allows the seal to float radially until the seal is concentric with the rotating shaft. The seal is split at the horizontal center line and has an anti-rotation pin at the top. The two seal halves are held together by a garter spring.

The inner seal is the floating labyrinth as described above, except the seal carrier is integral with the housing. In addition, an air seal provides for pressure equalization to prevent low pressure inside of the machine from pulling oil past the inner labyrinth seal. The air seal is split at the horizontal center line and bolts to the housing. Pressure equalization is achieved by tubes that connect the area between the air seal and the inner labyrinth seal to the outside of the machine.

The split oil rings are accurately machined with overlapping splits. The splits are secured with dowel pins and held together with screws as shown in Figure 5M1. Oil ring guides integral to the upper half of the bearing shell locate the ring and direct oil flow into the bearing.

The lower part of the oil ring is immersed in the oil of the bearing housing reservoir. When the shaft rotates, the journal drives the oil ring and that part which was immersed carries oil to the journal where it is deposited to provide lubrication.

The standard procedure for high speed bearings is to supplement the oil ring with lubricant from an additional reservoir that is circulated by a pump. If bearing losses are higher than can be dissipated from reservoir surfaces, an oil cooler is added to the lubrication system. The oil rings are retained as an aid to start-ups and to provide bearing protection during coast down in the event of an external oil system failure.

Induction Motors	
Bracket Bearings, Spherical Seat Self-Aligning	Part 5
Description (continued)	Sect. B

Externally supplied lube oil reaches the bearing shell by means of a passage drilled through the housing seat (Fig. 19M1). Oil then enters a groove around the outside diameter of the bottom half of the bearing shell. This groove carries oil to radial channels machined into the horizontal split at each side of the bearing shell, where the oil is carried to the bearing pocket to lubricate the bearing.

Induction Motors
Bracket Bearings, Spherical Seat Self-Aligning
Lubrication

Part 5
Sect. C

LUBRICATION

See Outline Drawing, Fig. 1, for lubrication recommendations.

For self-cooled bearings, the nominal oil level (with the machine stopped and oil at ambient temperature) is at the center of the oil level sight glass. For flood lubricated bearings, the standstill oil level will be below the center of the glass. The minimum oil level is visible above the bottom of the glass. The maximum level is visible below the top of the glass. However, an oil level above the center of the glass might increase the possibility of an oil seal leak.

Bearing temperatures, as measured by a bearing temperature detector, should not exceed 90°C (194°F) total temperature or 50°C rise (90°F rise) over ambient temperature for self-cooled bearings.

Induction Motors	
Bracket Bearings, Spherical Seat Self-Aligning	
Disassembly	

Part 5

Sect. D

DISASSEMBLY

Special care should be taken when dismantling bearings to keep all parts and components as clean as possible.

1. Remove frame end cover. Note that bolts for attaching cover to bearing housing are metric and bolts for attaching cover to frame are inch dimensioned.
2. Remove all bearing temperature sensors that enter the bearing housing.
3. Remove outer seal. Note that all bolts for bearing housing, bearing and seals are metric socket head.

Note When removing seals, all parts from each seal should be kept together and not mixed with parts from other seals. Use matchmarks to insure this. The removal procedure depends upon the type of seal that has been installed. Follow the appropriate section below.

Floating Labyrinth

Method A - Remove bolts that attach seal carrier to bearing housing, and support lower half of seal carrier to keep it from dropping. Slide seal assembly along shaft until seal carrier is clear of bearing housing. Remove seal carrier halves, leaving floating labyrinth in place around the shaft. Remove garter spring by unscrewing the spring joint. Remove two halves of floating labyrinth seal from shaft.

Method B - With seal carrier still attached to bearing housing, remove housing cap to expose floating labyrinth seal. Remove garter spring by unscrewing the spring joint and pulling spring free of seal. Lift top half of seal from shaft. Roll lower half of seal out of housing.

Induction Motors
Bracket Bearings, Spherical Seat Self-Aligning
Disassembly (continued)

Part 5
Sect. D

Floating Labyrinth with Fixed Seal

Remove screws that attach fixed seal to seal carrier. Remove the two halves of the fixed seal. Remove remaining floating labyrinth seal as described above.

4. Remove top half of air seal by removing the three or four bolts that attach seal to housing and the two bolts at the horizontal split of the seal.
5. Remove the four bolts holding the bearing cap to the bearing housing. Lift the bearing cap off of the bearing housing, being careful not to damage the inner floating labyrinth seal.
6. Remove floating labyrinth as described in Item 3, Method B, above.
7. Rotate the oil ring until the splits are at a convenient location. Remove the split screws from both splits and keep the screws associated with the split they were removed from. Gently tap the splits with a wooden screwdriver handle or other soft tool to disengage the dowels. When both splits are separated, remove the oil ring and reassemble it to avoid mixups in ring halves or split screws and to protect the splits from accidental damage.
8. Lift the shaft a few thousandths of an inch to remove the rotor weight from the bottom half bearing. This can be done with a jack lifting the shaft extension at the rear end, or lifting against a stud threaded into the tapped hole in the front end of the shaft. Be sure that a wooden block or soft metal shim is used between the shaft surface and the jack. Roll out the lower half of the bearing.

CAUTION

Use extreme care when rolling out lower half bearing, that hands or fingers are not in a position to be caught by the lower half bearing if it is accidentally released and rotates back to the bottom position. Serious personal injury can result.

Induction Motors
Bracket Bearings, Spherical Seat Self-Aligning
Inspection

Part 5

Sect. E

INSPECTION

Check the bearings to insure that no foreign material is present. Any hard particles imbedded in the babbitt must be removed and the source of contamination must be eliminated. Clean the bearings with lintless rags soaked in clean oil.

Examine the babbitt surfaces of both halves for evidence of unusual conditions. Rub marks in the top half usually result from mis-alignment. Rub marks on the babbitted thrust faces indicate axial thrust loads, usually resulting from improper axial alignment or failure of the coupling to limit the end float. Refer to Installation-Alignment Section of this leaflet. Note any evidence of bearing wiping or pulling of the babbitt metal. This is generally the result of overloading the bearing due to misalignment or vibration or both. If the wiping damage is not severe, it can be cleared by scraping away the high spots due to displaced metal.

Observe the wear pattern on the babbitt surface of the bottom half bearing. Ideally this should appear to be a band of uniform width extending axially the full length of the lower half and centered on the bottom of the babbitt surface. If the wear pattern is uneven in width, it may be due to an improperly fitted bearing or a bent shaft. Isolated circumferential scratches in the lower bearing babbitt surface may be due to foreign particles passing through the oil film or to nicks on the journal surface. General surface roughness may be due to abrasive particles in the oil. Check the journal surface for protruding sharp edges and smooth them off.

Look for pitting of the bearing surface due to bearing currents, or roughness due to corrosion or careless handling. If pitting due to bearing currents is found, determine the source of the short circuit bypassing the bearing insulation and correct it. Bearing insulation resistance when checked with a 3 volt ohmmeter should not indicate a shorted condition.

Drain the bearing reservoirs by removing the pipe plug at the bottom of the bearing housing. Flush out the reservoir with clean oil or kerosene. Reassemble the drain plug with its copper sealing gasket.

Induction Motors	
Bracket Bearings, Spherical Seat Self-Aligning	Part 5
Inspection (continued)	Sect. E

Examine the oil rings for nicks or scratches on the inner diameter and flat portions of the sides. Carefully remove any raised burrs with a fine tooth file.

If minor scraping performed on the bearing does not produce satisfactory results, or if the inspection indicates that the bearing is unsatisfactory, refer to Replacement Section of this manual for specific instructions.

Thoroughly clean all seal components of dirt, grease, old sealant and old gasket material. Inspect all seal components for nicks, burrs, scratches, cracks or other damage. Smooth nicks and burrs with an appropriate stone or sandpaper. Replace damaged or excessively worn parts.

Check fit of floating labyrinth in seal carrier. It should fit snugly, but not bind. The seal should be free to float radially in the carrier, deburr if needed.

Induction Motors
Bracket Bearings, Spherical Seat Self-Aligning
Bearing Replacement

Part 5
Sect. F**BEARING REPLACEMENT**

Standard sleeve bearings are Spherical Seat Type. This means that the bearing support allows self-alignment of the bearing to conform to shaft journal attitude. It is very important to check the fit of a new or re-babbitted bearing to the shaft journal. The following procedure is recommended:

1. Check the shaft journal to be sure that there are no sharp high spots or sharp edged scratches on its surface. Carefully remove any high spots or sharp edges with a suitable fine stone. Check to see that the repair is satisfactory by rubbing a piece of babbitt metal or solder over the repair with heavy hand pressure and note whether any soft metal is machined or cut by the spot.
2. Examine the new bearing (bottom half only) in the area where the oil reliefs blend into the bearing bore. There should be no sharp edges. Scrape lightly if required to make this a smooth transition, but do not extend the relief any further by excessive scraping.
3. Wipe all excess oil from the babbitt surface of the lower bearing half and the journal. Blue the bearing if desired, but it is not required. Lubricate seat in bearing housing. Roll the lower bearing half into place. Note that for flood lubricated bearings, the oil feed groove must be to the outboard side of the housing.

CAUTION

When rolling in a lower half bearing, take care to keep hands and fingers out of the way of bearing shell to prevent serious personal injury. The bearing will start in slowly, but will accelerate rapidly after it has been rolled in about 30 degrees.

Induction Motors

Bracket Bearings, Spherical Seat Self-Aligning

Bearing Replacement (continued)

Part 5

Sect. F

4. Check for proper alignment. The horizontal split of the bearing should be parallel to the housing split. The space between the bearing thrust face and the journal thrust surface should be equal from side to side. Gaps between lands of the bearing and the journal should be equal side to side. Tap the steel part of the bearing with a soft faced hammer, if required, to bring the bearing into alignment.
5. Release the jack or shaft support to let the journal rest on the lower half bearing. Rotate the shaft three complete revolutions in the normal direction of rotation. Lift the shaft and carefully roll out the lower half. Examine the resulting pattern of high spots as indicated by no bluing or shiny spots if bluing was not used. Ideally, this pattern should be a band of uniform width 1 to 2 inches wide running axially along the bottom of the babbit surface with no skew. The journal contact spots should comprise 75 percent of the band. If this is not observed, lightly scrape the existing high spots to change the pattern as required. Re-install the lower half and repeat the sequence of rotating the shaft. Removing and scraping the lower half until the desired pattern is obtained.

Induction Motors	
Bracket Bearings, Spherical Seat Self-Aligning	Part 5
Reassembly	Sect. G

REASSEMBLY

Assemble the bearings in the reverse order as described in Bearing Disassembly. When assembling the oil ring, it is only necessary to engage the fit at the ring split and use the screws to pull the split of the ring into position by alternately tightening the screws at each split.

CAUTION There should be no screws or dowels extending beyond the sides of the ring. The splits of the ring must be smooth on the sides as well as in bore. All burrs must be removed. Rings must be handled carefully to prevent bending or damage at the splits.

Clean the parting surfaces of the bearing bracket and cap and spread a thin coat of sealer Curil-T before assembling cap.

Apply a non-hardening sealant Curil-T to the floating labyrinth as shown in Fig. 27M1. Apply a thin coating of sealant only to the surfaces indicated in Fig. 27M1. Assemble seal by one of two methods:

Method A - Install two halves of floating labyrinth on shaft and retain with garter spring. Lower half of seal has drain holes drilled into labyrinths. Upper half has anti-rotation pin. Both drains and anti-rotation pin are to be toward inboard side of bearing housing. Set top half of seal carrier onto floating labyrinth, with anti-rotation pin in line with slot in carrier. Lightly coat horizontal split with sealant and install bottom half of seal carrier onto floating labyrinth. Use gasket or sealant between carrier and housing and slide seal assembly along shaft to housing. Install bolts to fasten carrier to housing.

Method B - Use when seal carrier is to remain bolted to housing or when carrier is integral with the housing. Install lower half of floating labyrinth (with labyrinth drains inboard) and garter spring by rolling them into the lower part of seal carrier. If shaft is not installed, the seal and spring can be installed into the carrier directly. Set top half of floating labyrinth on installed shaft with anti-rotation pin toward the inboard side of bearing housing. Use garter spring to retain the two seal halves. Insure that anti-rotation pin will line up with slot in carrier.

Induction Motors	
Bracket Bearings, Spherical Seat Self-Aligning	Part 5
Reassembly	Sect. G

This can be done by locating the seal split line to coincide with the seal carrier split line. Before installing bearing housing cap, lightly coat the seal carrier split surfaces with sealer. Install cap, being careful not to damage the floating labyrinth seal.

Floating Labyrinth with Fixed Seal

Assemble floating labyrinth seal per instructions above. Install fixed seal to seal carrier using sealant. Lower half has drain hole. Place a .002 feeler gage between seal and shaft at the 6 o'clock position, then press lower half of seal up against gage with hand. Equalize (side to side) gaps between shaft and seal at horizontal split. Tighten lower half retaining bolts. Lightly coat horizontal split with sealant. Install top half of seal in line with and in contact with lower half at horizontal split. Tighten upper half retaining bolts.

Induction Motors

Bracket Bearings, Spherical Seat Self-Aligning

Bearing Insulation - Shaft Currents

Part 5

Sect. H

BEARING INSULATION - SHAFT CURRENTS

Shaft Currents

Variations in reluctance in the magnetic circuit of an alternating current machine may cause cyclic changes in the amount of flux which links the shaft. This change in flux may generate sufficient voltage to circulate current through the circuit consisting of shaft, bearings, and frame or bedplate or reinforcing members in the concrete. If this current is permitted to flow, it soon has a destructive effect on the shaft journals and bearings.

Detecting Bearing Currents

If a machine has bearing currents it is usually possible to detect them when machine is running at rated speed and voltage by placing one end of a copper wire on the bearing cap and touching the other end to the shaft, causing sparks to be drawn.

If sparks occur when this procedure is performed at both ends of the machine, bearing currents are present, and insulation should be provided or if insulation is already provided it should be inspected, cleaned and rechecked unless periodic inspection of bearings show that insulation is unnecessary. If, however, sparking occurs at the insulated end only or at neither end, bearing currents are probably not present.

Insulation

As it is not practical to provide control of the generation of shaft voltages and currents, it becomes necessary as a minimum to insulate a bearing. In general, the bearing at the end opposite the shaft extension is insulated. This insulation interrupts the path for circulating currents. It consists of a suitable thickness of insulating material bonded to the spherical seat in the housing. To avoid short circuiting this insulation, the anti-rotation pins are insulated. See Figure 18M4.

Induction Motors

Bracket Bearings, Spherical Seat Self-Aligning

Part 5

Bearing Insulation - Shaft Currents (continued)

Sect. H

Any connections, such as a temperature detector, made to the insulated bearings must also be insulated from them. Care should be taken so that this insulation is never grounded in any manner.

A break in the insulation may occur during assembly due to careless handling and it is well to test for this with a megger. To make this test a section in the shaft-bearing-frame circuit must be free from ground, the customary procedure being to raise the shaft free from the non-insulated bearing, unless all bearings are insulated. In this case, it is only necessary to remove the grounding strap (or straps).

Machines which are coupled on both ends have both bearings insulated and must be provided with an insulated coupling on one end.

Operating Temperature

Bearings are designed to operate satisfactory to 90°C operating temperature measure by spring loaded RTD's or thermocouples that measure the steel liner temperature near the bottom center part of the bearing. Due to changes in oil viscosity with operating temperature of self lubricated bearings, the relationship between ambient temperature and bearing operating temperature is not directly proportional. See Figures 28 and 29. Refer to this curve to determine if it is operating properly when the temperature is other than the design temperature. If the temperature exceeds that indicated as the limit line, check the following:

1. Be sure the correct oil viscosity is being used.
2. Is the oil level visible in the sight window?
3. Is the oil ring turning properly as viewed through the sight window in the top of the bearing?
4. Has the oil been changed at proper intervals?
5. Has there been vibration that may have damaged the bearing?

If the proper operation cannot be corrected, a complete inspection of the bearing is in order.

Induction Motors

Bracket Bearings, Spherical Seat Self-Aligning

Bearing Brackets and Housing Assembly

Part 5

Sect. I

BEARING BRACKETS AND HOUSING ASSEMBLY

Removal and Reassembly

1. If the machine is flood lubricated, disconnect the oil inlet and drain piping at suitable locations to permit bearing bracket and housing assembly removal.
2. Remove the bearing caps and bearing as described in Bearing Disassembly Section of the manual. Remove bolts that attach lower half of air seal to the bearing housing, let lower half of air seal hang by the two pressure equalization hoses. While the rotor is supported by a jack or overhead lifting device, insert shim material, preferably non-metallic, in the lower half of the air gap taking care not to cut or damage the stator winding. There should be two shims of suitable thickness approximately 3 inches wide by 12 inches long, located about 15 degrees each side of the bottom vertical centerline. Lower the rotor so that it rests on the air gap shims and check to be sure that the shaft does not contact the bearing housing.
3. Back out the dowels that locate bracket to frame by tightening the nuts on the threaded portion of the dowel.
4. Remove the two topmost bracket bolts (one on each side of vertical centerline) and install two long (6 to 8 inch) high strength bolts SAE grade 5 or equivalent to serve as a bracket guide and stop. Remove the remaining bracket bolts. Slide bracket out on the long guide bolts to a position where suitable lifting devices can be attached to it. Remove the bracket weight from the two long guide bolts and remove the guide bolts. Lift the bracket and set it aside in a suitable place.

CAUTION

When handling or storing the bearing brackets, take care that the machined frame fit surface is not damaged. If any sliding of the bracket on floors or foundation is contemplated, use a protective shim between the bracket and the floor. Nicks, burrs, or distortion of the bracket frame fit surface can alter the air gap setting.

Induction MotorsBracket Bearings, Spherical Seat Self-Aligning

Part 5

Bearing Brackets and Housing Assembly (continued)

Sect. I

To reassemble the bearing brackets, reverse the steps described for removal. Inspect the locating surfaces on the bracket and the frame bore and remove any nicks or burrs that may alter the bracket location and/or the air gap before reassembly.

Induction Motors	
Accessories	Part 7
Listing of Accessories	Sect. A

LISTING OF ACCESSORIES

Space Heaters

When space heaters are specified they are usually mounted at the underside of the frame as indicated on the outline drawing. Heater elements may be replaced. Refer to the outline for voltage, phases, wattage and lead location of the heaters. When it has been indicated that the motor is to operate in an explosive hazardous environment, the heaters will be designed to operate at temperatures below the appropriate flash level.

When the motor is shut down for servicing, power to the heaters should be disconnected before personnel are permitted to approach the areas near the heater wiring. During normal shutdowns heater power is applied manually or by automatic control from the switchgear. Refer to Part 2 regarding use of space heaters when the machine is in storage.

Space Heater Replacement

WARNING Before replacing burned out spacer heaters, turn off all power to the motor by opening the appropriate switches and circuit breakers. Tag these controls to prevent their being closed by mistake.

The space heaters may be replaced as follows:

1. Remove side cover or covers. On bracket type motors, space heaters are mounted on a tray. This draw out tray can be unfastened and pulled out to give accessibility to heaters. The location of the access to this tray is shown on outline, Figure 1.
2. Disconnect leads from heater terminals.
3. Remove bolts which hold heaters in place.

Induction Motors	
Accessories	Part 7
Listing of Accessories (continued)	Sect. A

4. Place new heater in same location as burned out unit and replace bolts on end of heater, (replacements must be exactly the same as original equipment; consult the Westinghouse factory for style number).
5. Replace leads on heater terminals.

Stator Temperature Detectors

The outline drawing, Figure 1, will indicate the type of detectors when supplied. The most common resistance types are the 10 ohms at 25°C copper, 100 ohms at 0°C platinum, and 120 ohms at 0°C nickel. Usually they are the 10 ohm resistance type, that is, 10 ohms at 25°C. These insulated elements are located between upper and lower stator coils in the slots. Slots are selected which contain coils of the same phase. An equal number of detectors monitor winding temperatures of each of the phases. Slots containing detectors are distributed uniformly around the stator.

The 10 and 100 ohm resistance temperature detectors are provided with three leads, one red with (+) marking, and two white which have a common connector in the detector; one with a (-) marking and one with a (c) marking. These markings will be shown on the outline drawing with TD1 (+) (-) and (c) marking for one detector, TD2 (+) (-) and (c) marking for second detector, etc. The motors on this order have copper temperature detectors with 10 ohms at 25°C which have three leads. Refer to outline Figure 1 for method of connection. The three lead type of detector may be used in a balanced bridge type of temperature meter, which minimizes the influence of detector lead length on the meter reading. For any type of detector, consult the meter supplier's connection diagram for proper wiring to the meter.

Bearing Thermocouples

The bearing thermocouple is a thin metal tube containing two dissimilar types of thermocouple wires which, when joined inside at a junction, sets up an electro motive force readable on the customer's potentiometer (furnished by others) for bearing temperature. See Figure 2.

Induction Motors	
Accessories	Part 7
Listing of Accessories (continued)	Sect. A

Machine Protection (refer to Outline Drawing Figure 1.)

There are three basic types of machine protection. These are surge protection, ground fault protection and unbalanced phase protection.

Ground Fault Protection is necessary to limit the damage with a machine ground fault (stator winding shorting to ground in the machine). Ground fault protection is provided by measuring the difference between the current going into the phase measure by current transformers measured in the switchgear and current coming out of the phase measured by current transformers (type RCT) located in the neutral or located in other end of motor phase winding. The transformer ratio in the switchgear and the RCT ratio must be the same. This difference signal is used to operate a relay at some predetermined unacceptable level.

Unbalanced Phase Protection is necessary to protect the machine against problem such as an open or partially open phase, and high resistance series or phase group connections. This function is performed by metering (standard) current transformers or type RCT current transformers connected in the neutral of the motor winding. The outputs from the current transformers go to one common three phase relay which operates at a given level of unbalance.

The design features are:

1. Enclosure

The enclosures are made in several basic designs, completely assembled and painted with primer coat preparatory to final finish in user's color. The mild steel case is jig welded to insure accuracy of dimensions and for appearance. The front cover may be unbolted and removed with two handles. Both side covers may be unbolted and removed each with two handles.

<u>Induction Motors</u>	
<u>Accessories</u>	Part 7
<u>Listing of Accessories (continued)</u>	Sect. A

2. Power Entrance Provisions

The cabinet is designed to allow the ultimate customer space for stress cones inside cabinet and to bring leads from top or bottom and from right or left side of motor. Connections from the motor are clamped and then brought through opening in the rear panel of the cabinet. Customer lead may be brought into the cabinet by removing a plate and drilling to suit entrance conduit being used. Phase buses for customer leads are generally undrilled so that customer terminals may be used as a template in drilling leads. See the main lead cabinet drawing for specific details.

3. Ground Pad - Refer to outline, Figure 1.

Stainless Steel exterior grounding pad with pre-drilled holes to accept standard terminal connectors are located outside the cabinet. This grounding plate is tied electrically to all other ground points within the cabinet.

Induction Motors
Renewal Parts

Part 8

Sect. A

RENEWAL PARTS

Renewal parts information may be obtained from the nearest Westinghouse Sales Office. Be sure to name the part or parts required and give the complete nameplate reading on the motor for positive identification.

Induction Motors
Trouble Shooting
Problems - Cause

Part 9

Sect. A

PROBLEMS - CAUSE

The following is a summary of the more commonly encountered problems, their probable causes, and what to look for.

Trouble	Cause	Investigate
Motor will not start	Improper connections	Check motor and control connections.
	Improper line voltage	Check line voltage at motor terminals — see motor nameplate for voltage requirements.
	Protective devices tripped	Check overload relay or fuses
	Stator winding failure	Check for open circuit, short circuit or grounded wiring.
	Excessive load	Check motor rotor and load for locked or frozen condition. See starting duty nameplate for max. load inertia.
Hot bearing	Improper lubricant Improper oil level	See lubrication nameplate or outline drawing for recommended oil and proper oil level.
	Contaminated oil	Drain and refill. Check for dirt in bearings and sump.
	Oil ring stuck	Check ring for roughness and guides for alignment.
	Oil ring not immersed in oil	Immersion should be .5 to 1.0 inch in oil. Check for improper oil level or ring size.
	Flood lube system malfunction	Check oil supply pressure, flow rate, temperature. Look for obstruction in oil feed and drain lines or bearing orifice.
	Excessive load	Check alignment. Look for axial thrust loading. Check for bent shaft.

Induction Motors
Trouble Shooting
Problems - Cause (continued)

Part 9

Sect. A

Trouble	Cause	Investigate
Hot bearing (continued)	Rough bearing surfaces	Check for displaced babbit, pitting due to bearing currents, corrosion. Check bearing insulation if bearing surface is pitted. Scrape or re-fit bearing. Polish journal if required.
Oil leaks	Housing split surfaces not sealed. Breather vent plugged.	Remove cap and check parting surfaces. Re-seal. Check for obstruction in vent.
	Excess oil or high pressure in flood lube supply	Check oil flow rate, level, orifice size, oil supply pressure.
	Improper oil drainage	Check drain lines for obstructions, proper slope.
	Incorrect grade of oil	Check outline drawing or lubrication nameplate for proper oil grade.
Vibration, noise Note: Always check vibration frequency and its relation to rotational speed N. 1XN = Rotational speed vibration frequency 2XN = Twice rotational speed vibration frequency. (Example: 3600 RPM motor; vibration frequency rotational speed. $N = \frac{3600}{60} = 60$ Hz.) 60 sec/min.	Rotor unbalance	1XN frequency. Re-check with motor uncoupled from load.
	Loose mounting or poor foundation	1XN frequency: Re-tighten bolts, check shims, stiffen mounting.
	Parts rubbing shaft	1XN - Phase angle varies with time.
	Broken damper bar	1XN - Amplitude is modulated with time. Most likely to occur under load.
	Coupling unbalance	1XN - Check to see if excess key is trimmed off — see Cross Section Drawing — Description Section.
	Worn coupling	1XN, sometimes 2XN.
	Misalignment	1XN, usually high axial amplitude, sometimes 2XN.

Induction Motors
Trouble Shooting
Problems - Cause (continued)

Part 9

Sect. A

Trouble	Cause	Investigate
Vibration noise, continued	Motor support structural resonance	1XN, large amplitude at motor feet — disappears quickly with speed change or when motor de-energized.
	Out of round journal	Multiples of rotational speed.
Low insulation resistance	Moisture, dirt, metallic particles or other contaminant	Motor cleanliness. Clean and dry out as required.
	Mechanical damage	Check oil bracing and wedging. Check for foreign objects or excessive vibration.
	Excessive temperature	Check for overloads, ventilation restrictions, excessive dirt build up, unbalanced voltages, improper voltage.

Induction Motors	
Illustrations	Part 10
Introduction	Sect. A

INTRODUCTION

This part includes all drawings, pictures, sketches, schematics, tables, etc. that are referred to in the main text of this book. For purposes of simplification and quick location they are all labeled as Figures. It is recommended that frequent and careful references be made to those figures as a valuable aid in understanding this equipment and in using this manual. To help in locating a specific figure, an index of the figures contained in this part is included as portion of the index in the beginning of this manual.



FIGURE 2-M-1

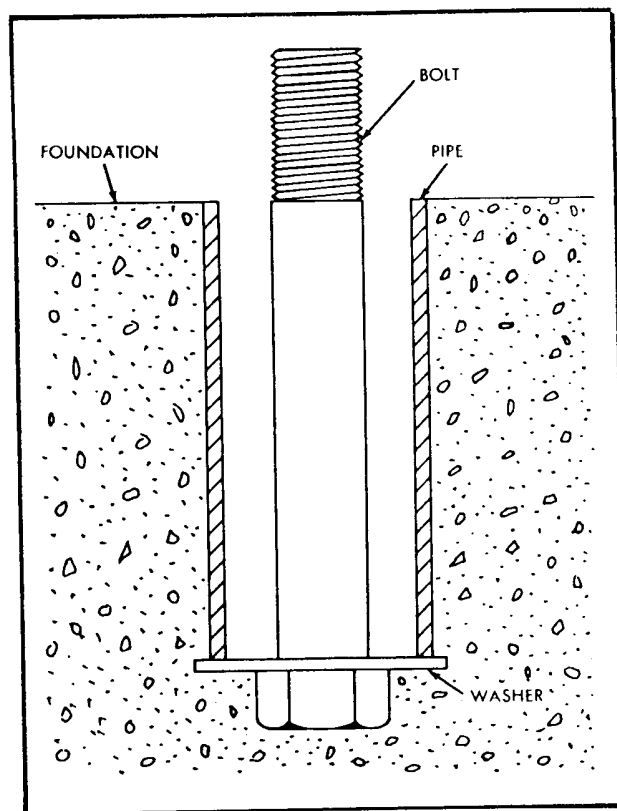


FIGURE 3

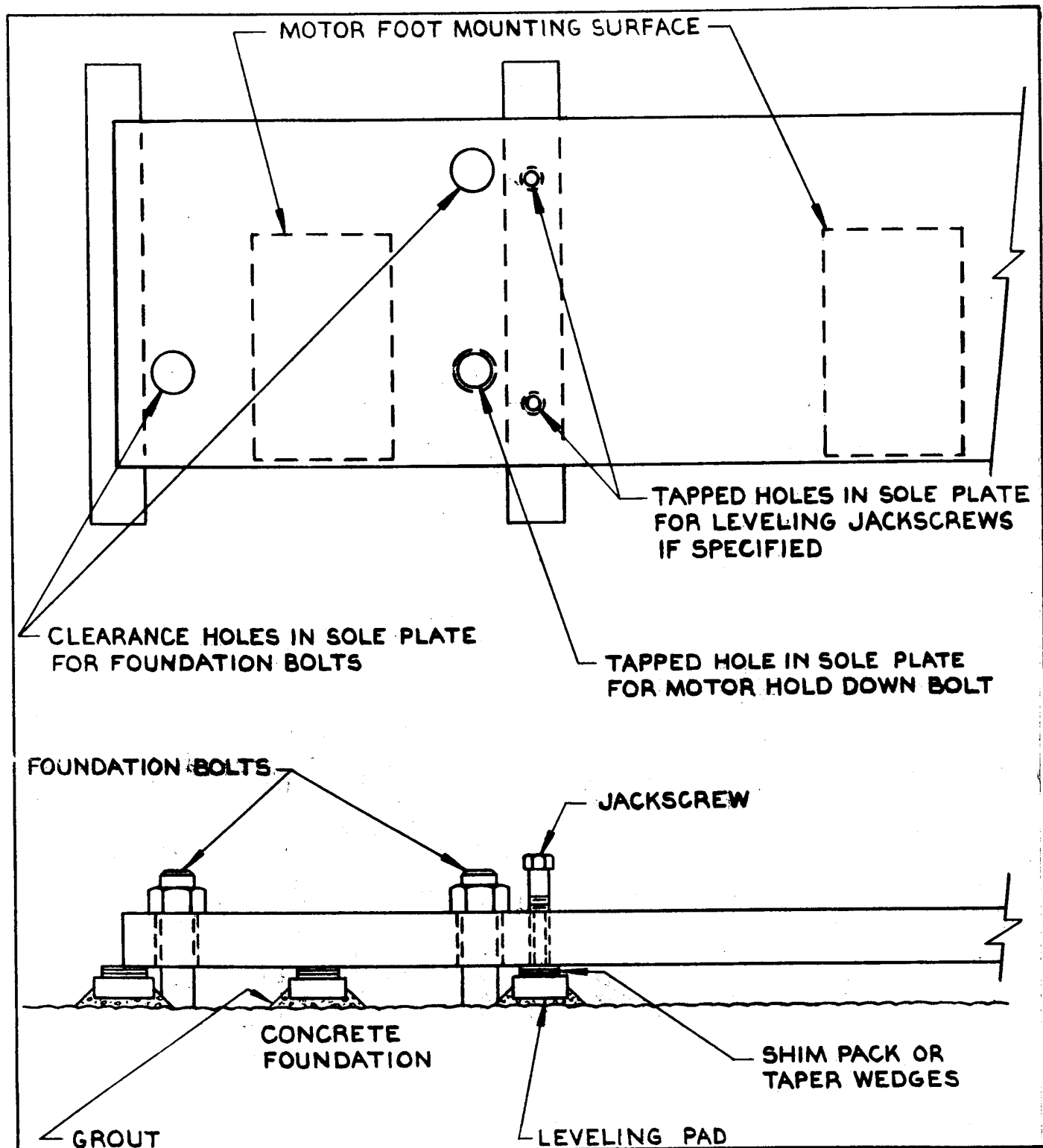


FIGURE 4

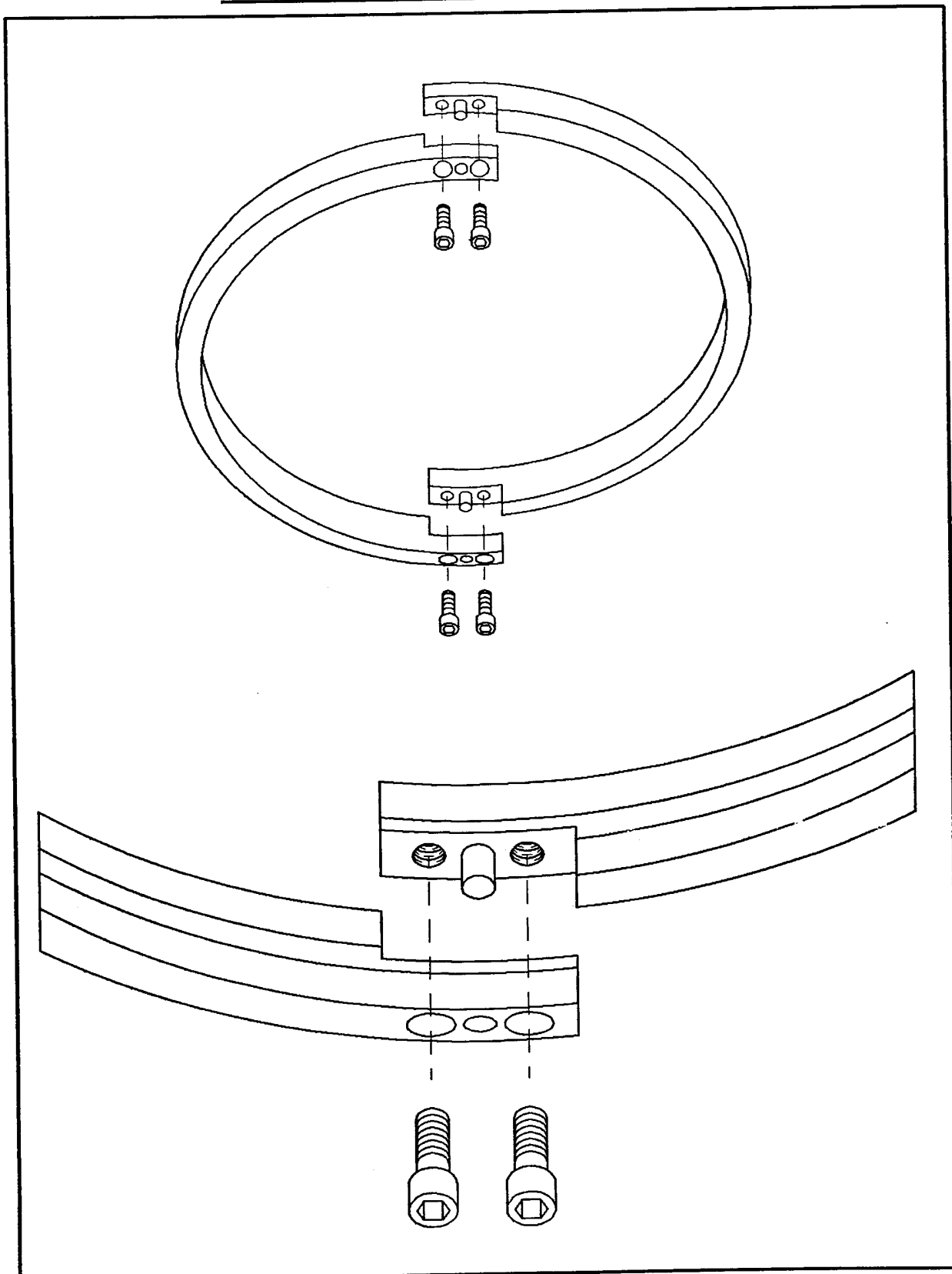


FIGURE 5 M I

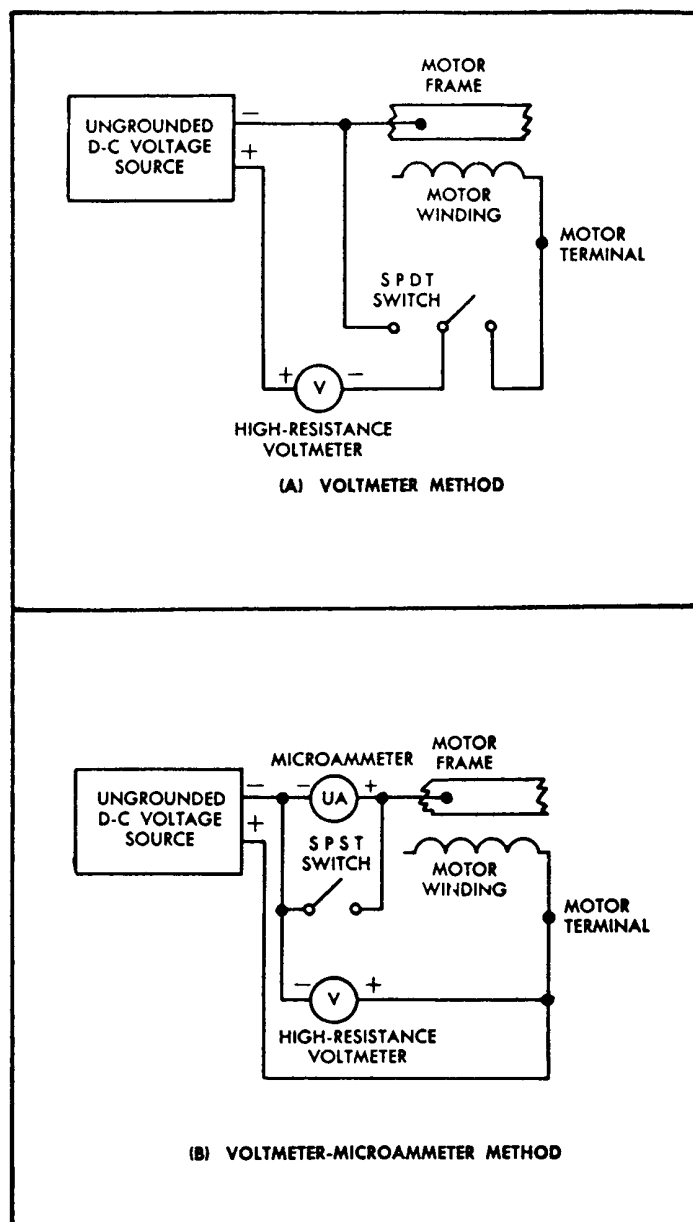


FIGURE 6

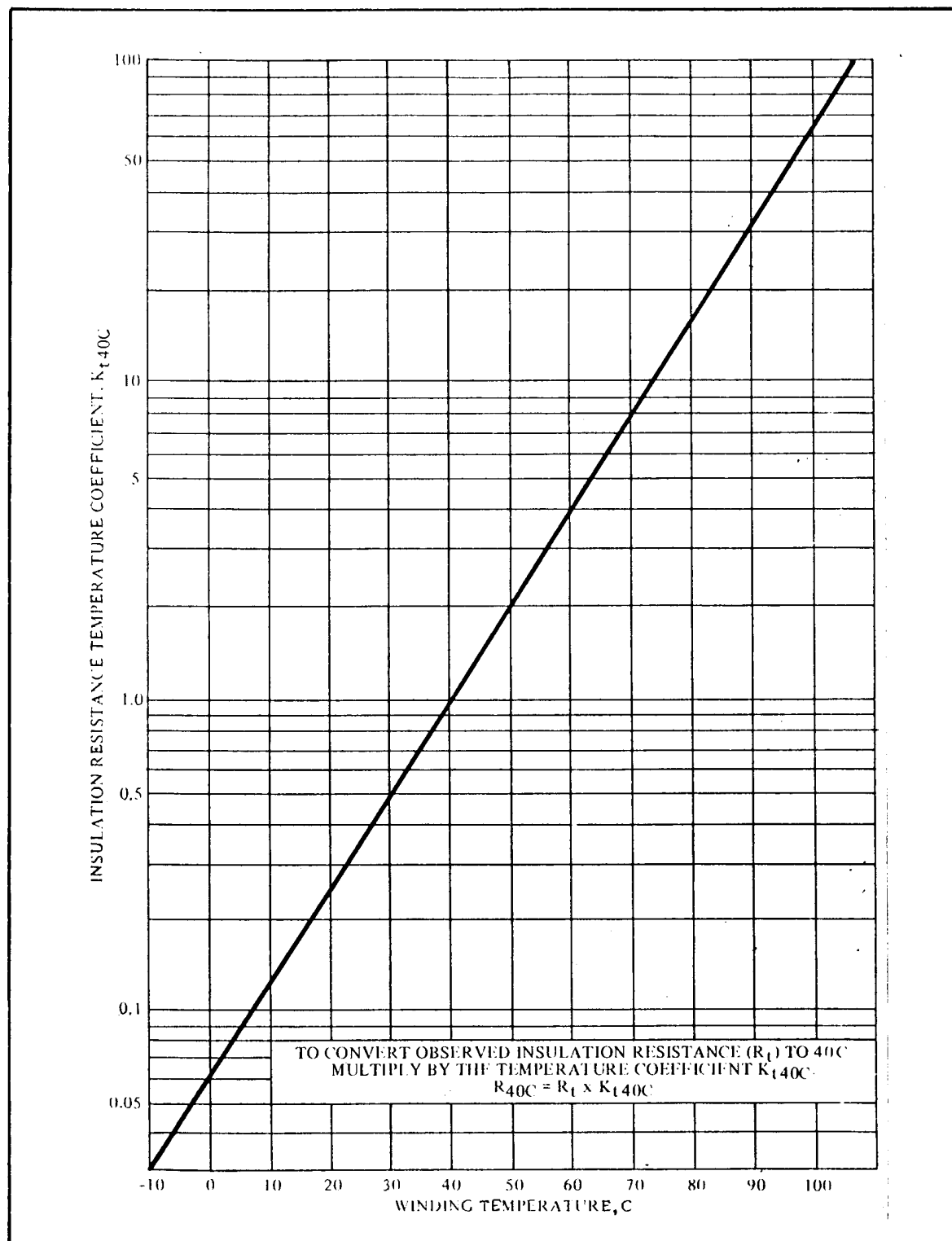


FIGURE 7

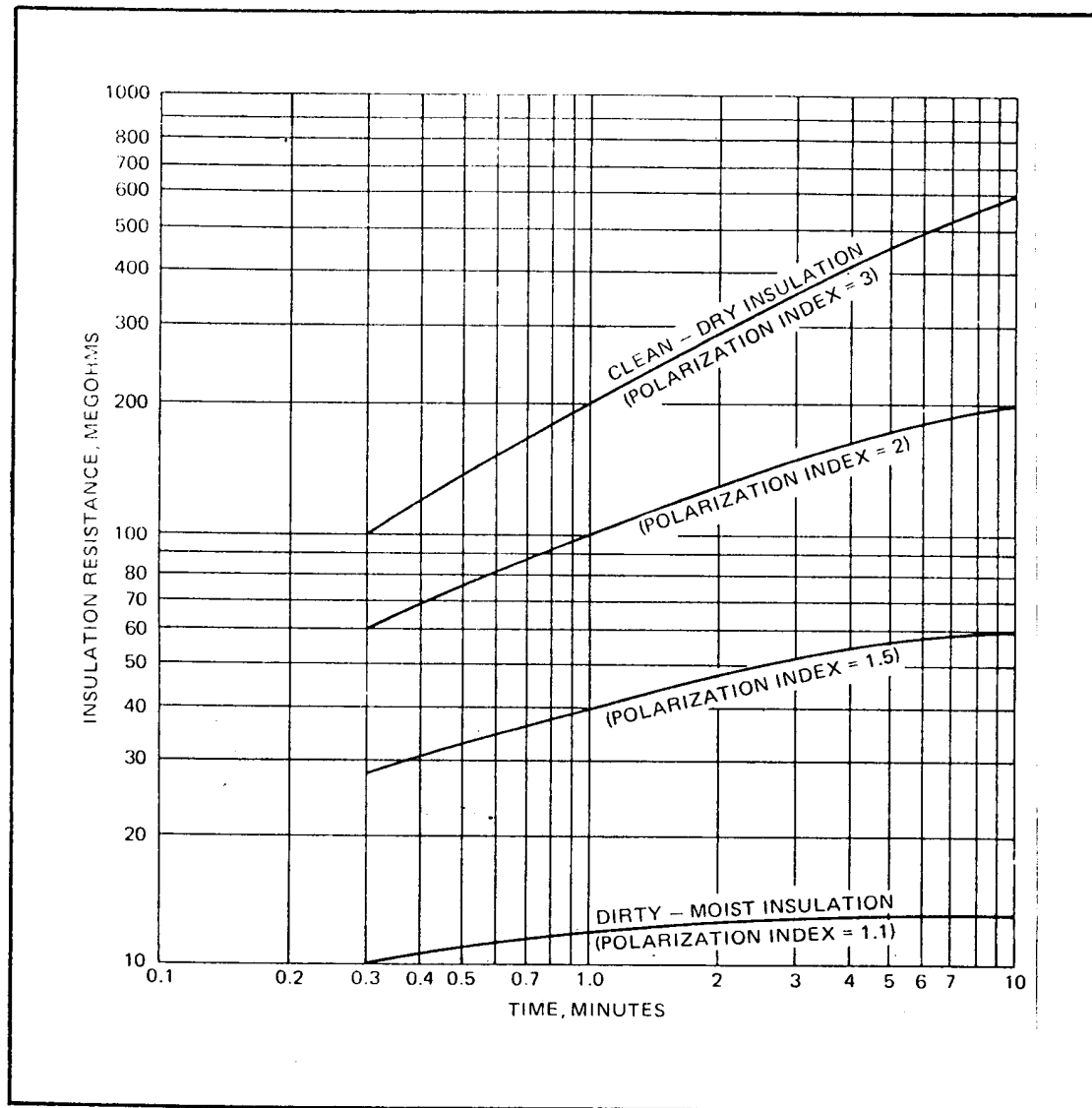


FIGURE 8

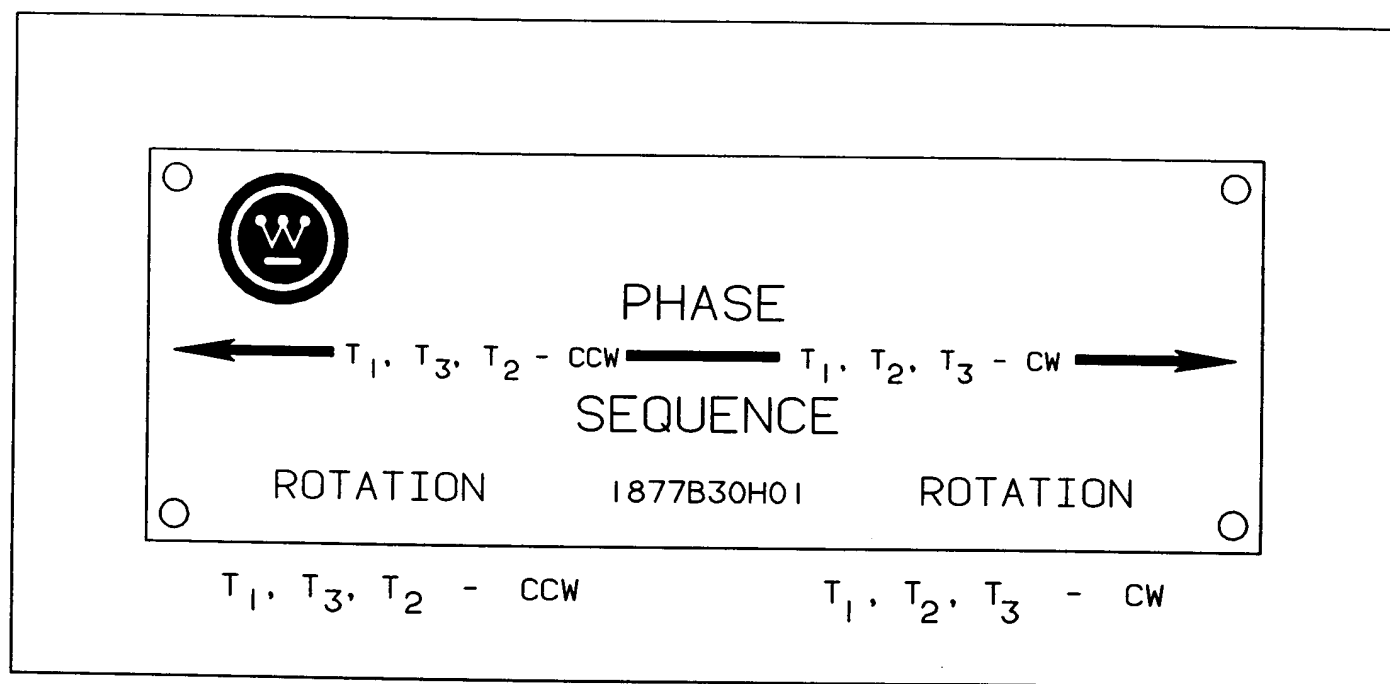


FIGURE 10 B

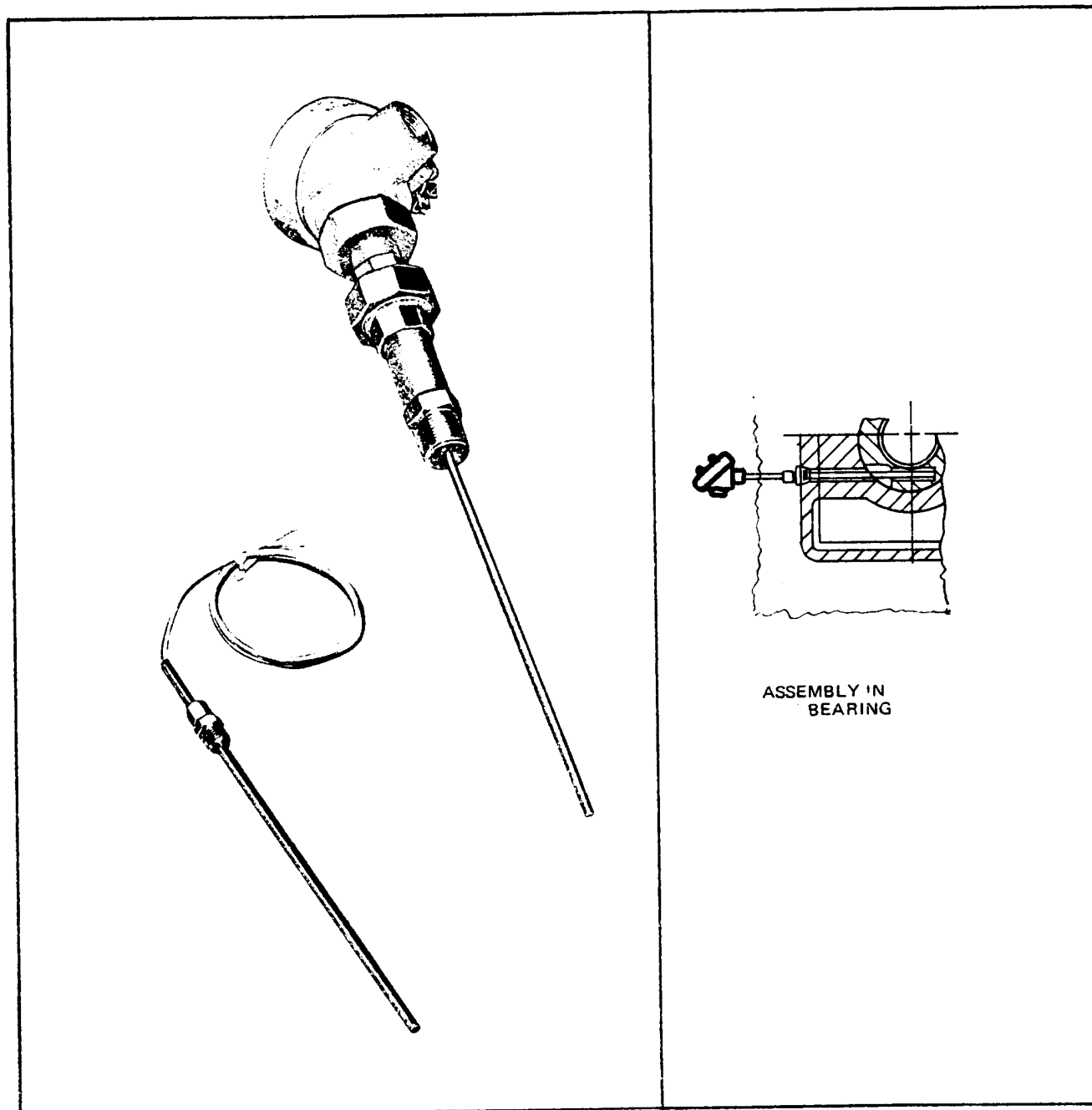


FIGURE 11 A

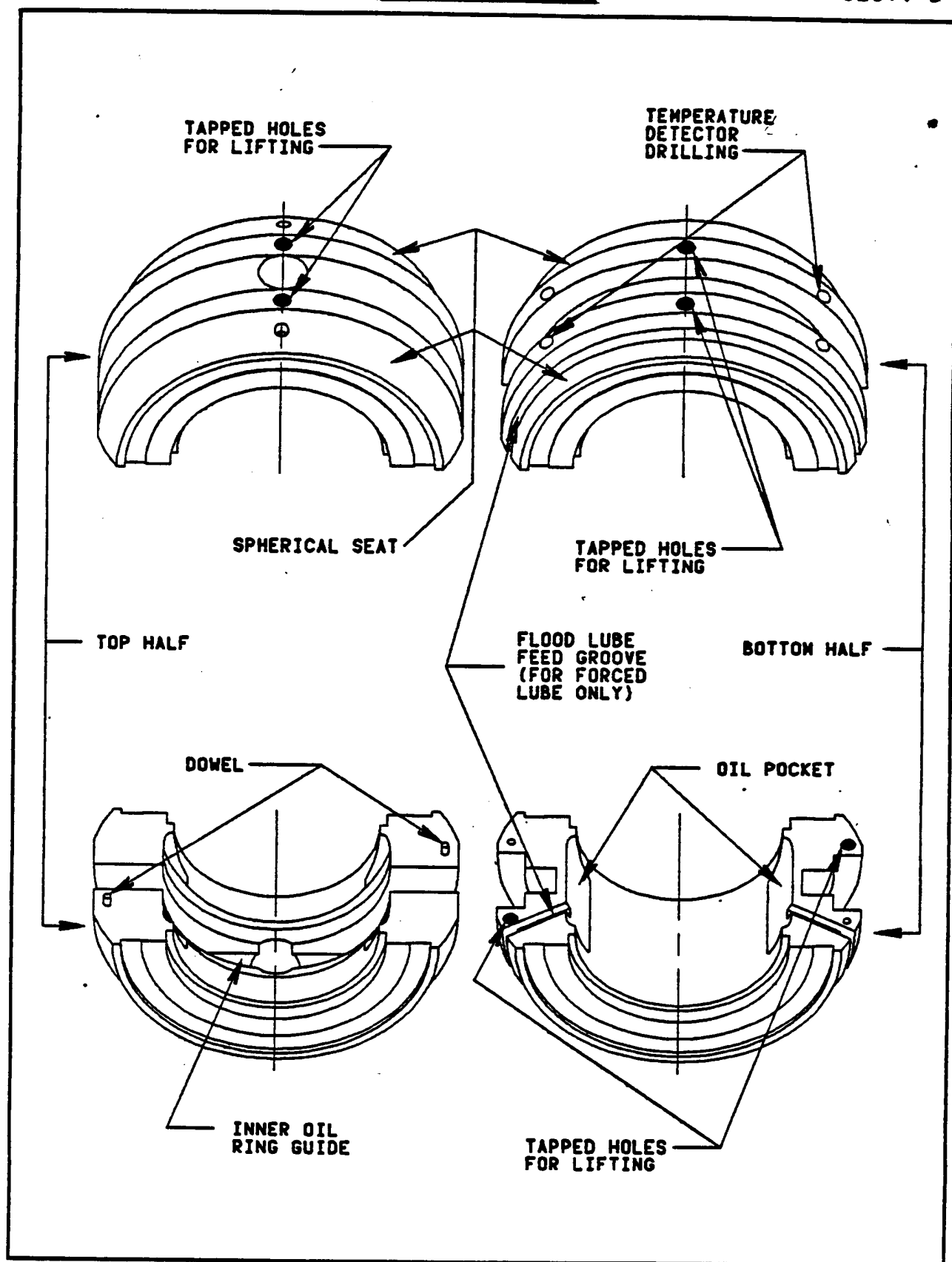
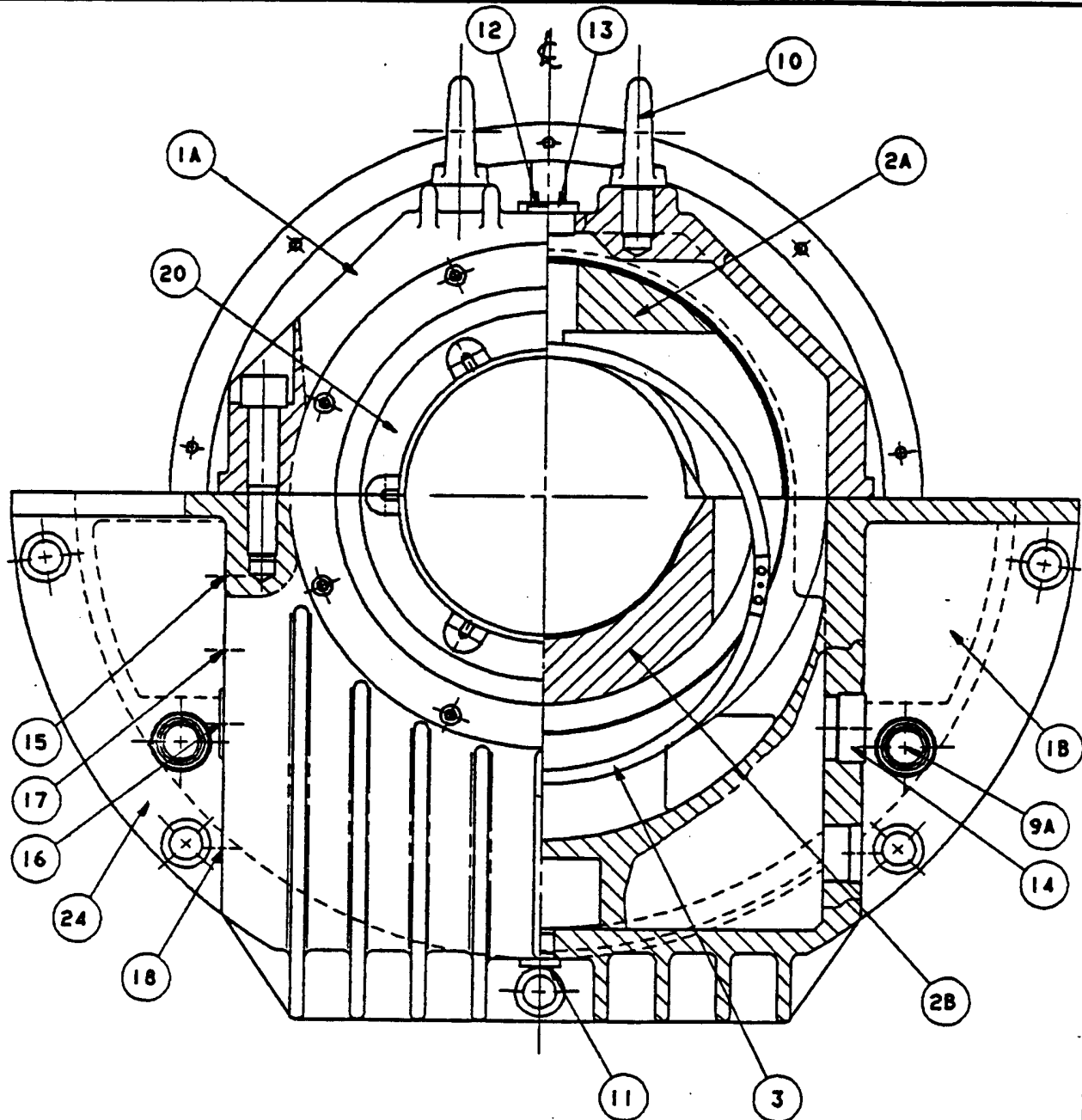


FIGURE 17 M 1

A.C. MACHINES
ILLUSTRATIONS - FIGURES
SLEEVE BEARING CROSS SECTION

PAGE 98
PART 10
SECT. B

- | | |
|----------------------------------|--|
| 1A - HOUSING CAP | 13 - OIL RING VIEW GLASS |
| 1B - HOUSING | 14 - OIL LEVEL SIGHT GUAGE |
| 2A - BEARING (LINER) UPPER HALF | 15 - FLOOD LUBE INLET |
| 2B - BEARING (LINER) LOWER HALF | 16 - FLOOD LUBE RETURN |
| 3 - OIL RING | 17 - BEARING TEMPERATURE DETECTOR PORT |
| 9A - PRESSURE EQUALIZING PASSAGE | 18 - OIL SUMP HEATER PORT |
| 10 - LIFTING EYE BOLT | 20 - THRUST FACE |
| 11 - DRAIN PLUG | 24 - MOUNTING FLANGE |
| 12 - FILL PLUG | |



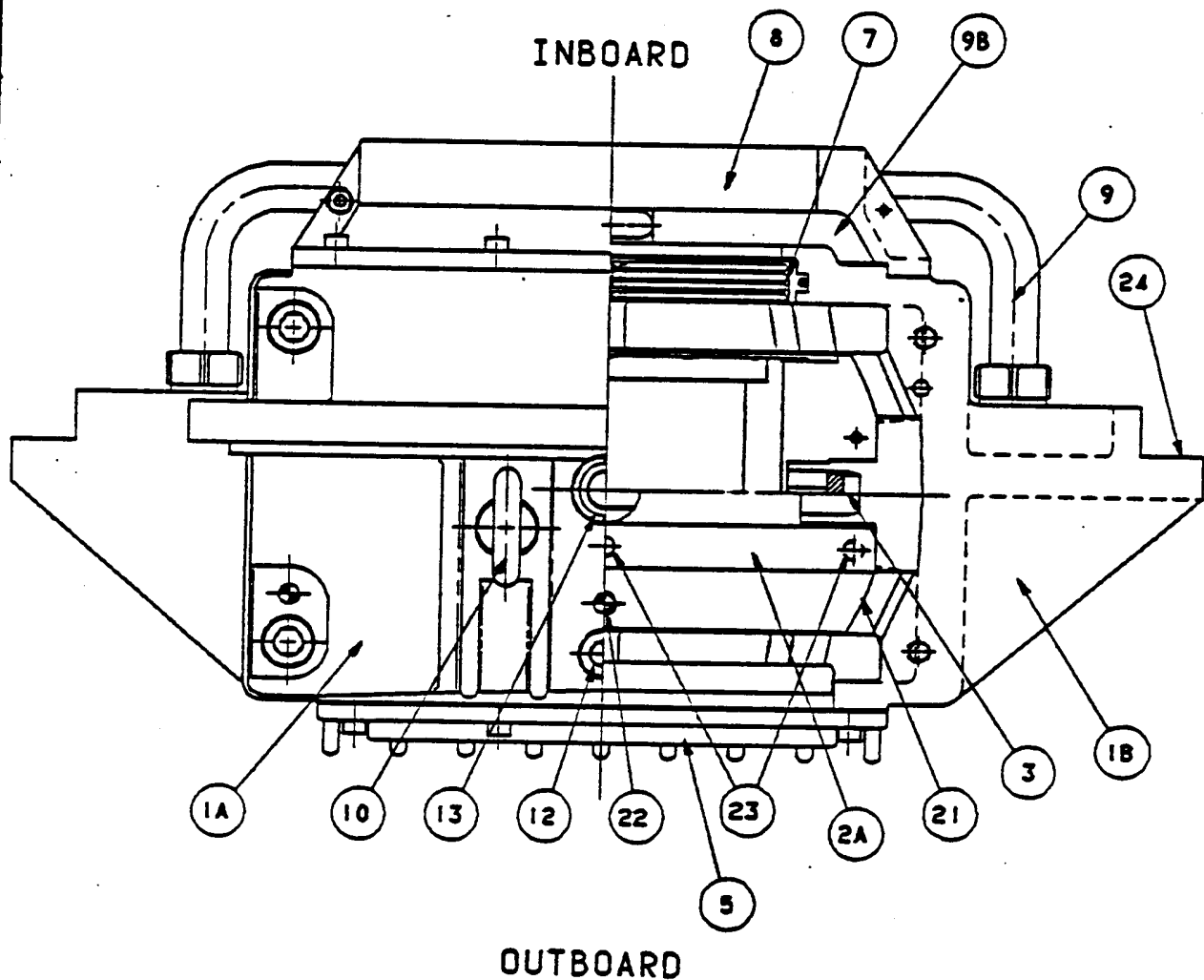
OUTBOARD END VIEW

FIGURE 18 M 1

A.C. MACHINES
ILLUSTRATIONS - FIGURES
SLEEVE BEARING CROSS SECTION

PAGE 99
 PART 10
 SECT. B

- | | |
|---------------------------------|------------------------------------|
| 1A - HOUSING CAP | 9B - PRESSURE EQUALIZING CAVITY |
| 1B - HOUSING | 10 - LIFTING EYE BOLT |
| 2A - BEARING (LINER) UPPER HALF | 12 - FILL PLUG |
| 3 - OIL RING | 13 - OIL RING VIEW GLASS |
| 5 - OUTER SEAL CARRIER | 21 - SPHERICAL SEAT |
| 7 - INNER SEAL | 22 - ANTI-ROTATION PIN |
| 8 - AIR SEAL | 23 - TAPPED HOLE FOR LIFTING LINER |
| 9 - PRESSURE EQUALIZING TUBE | 24 - MOUNTING FLANGE |



TOP VIEW

FIGURE 18 M 2

A.C. MACHINES
ILLUSTRATIONS - FIGURES
SLEEVE BEARING CROSS SECTION

PAGE 100
 PART 10
 SECT. B

- | | |
|----------------------------------|--|
| 1A - HOUSING CAP | 10 - LIFTING EYE BOLT |
| 1B - HOUSING | 11 - DRAIN PLUG |
| 2A - BEARING (LINER) UPPER HALF | 12 - FILL PLUG |
| 2B - BEARING (LINER) LOWER HALF | 13 - OIL RING VIEW GLASS |
| 3 - OIL RING | 18 - OIL SUMP HEATER PORT |
| 4 - OUTER SEAL | 19 - BEARING TEMPERATURE DETECTOR DRILLING |
| 5 - OUTER SEAL CARRIER | 20 - THRUST FACE |
| 6 - SEAL GARTER SPRING | 21 - SPHERICAL SEAT |
| 7 - INNER SEAL | 22 - ANTI-ROTATION PIN |
| 8 - AIR SEAL | 23 - TAPPED HOLE FOR LIFTING LINER |
| 9A - PRESSURE EQUALIZING PASSAGE | 24 - MOUNTING FLANGE |
| 9B - PRESSURE EQUALIZING CAVITY | |

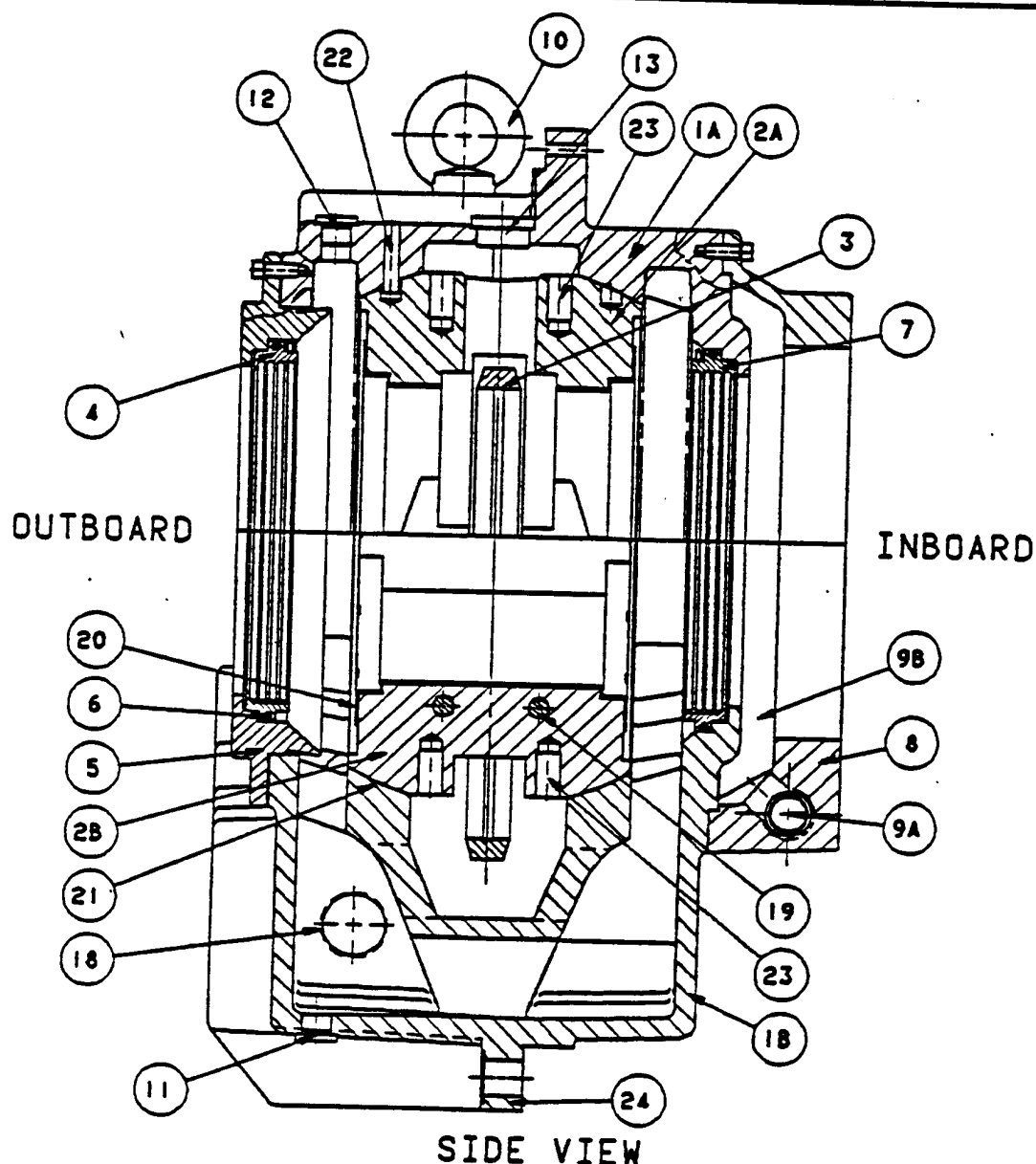
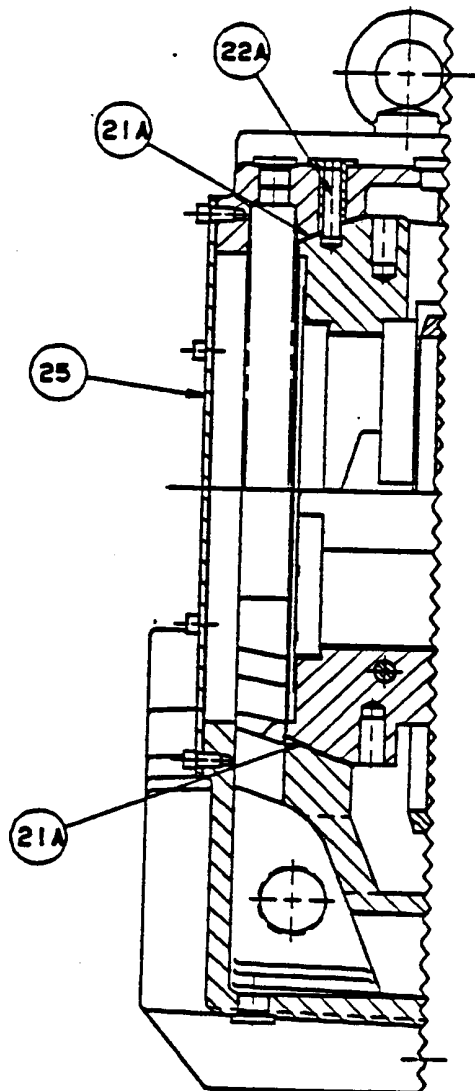


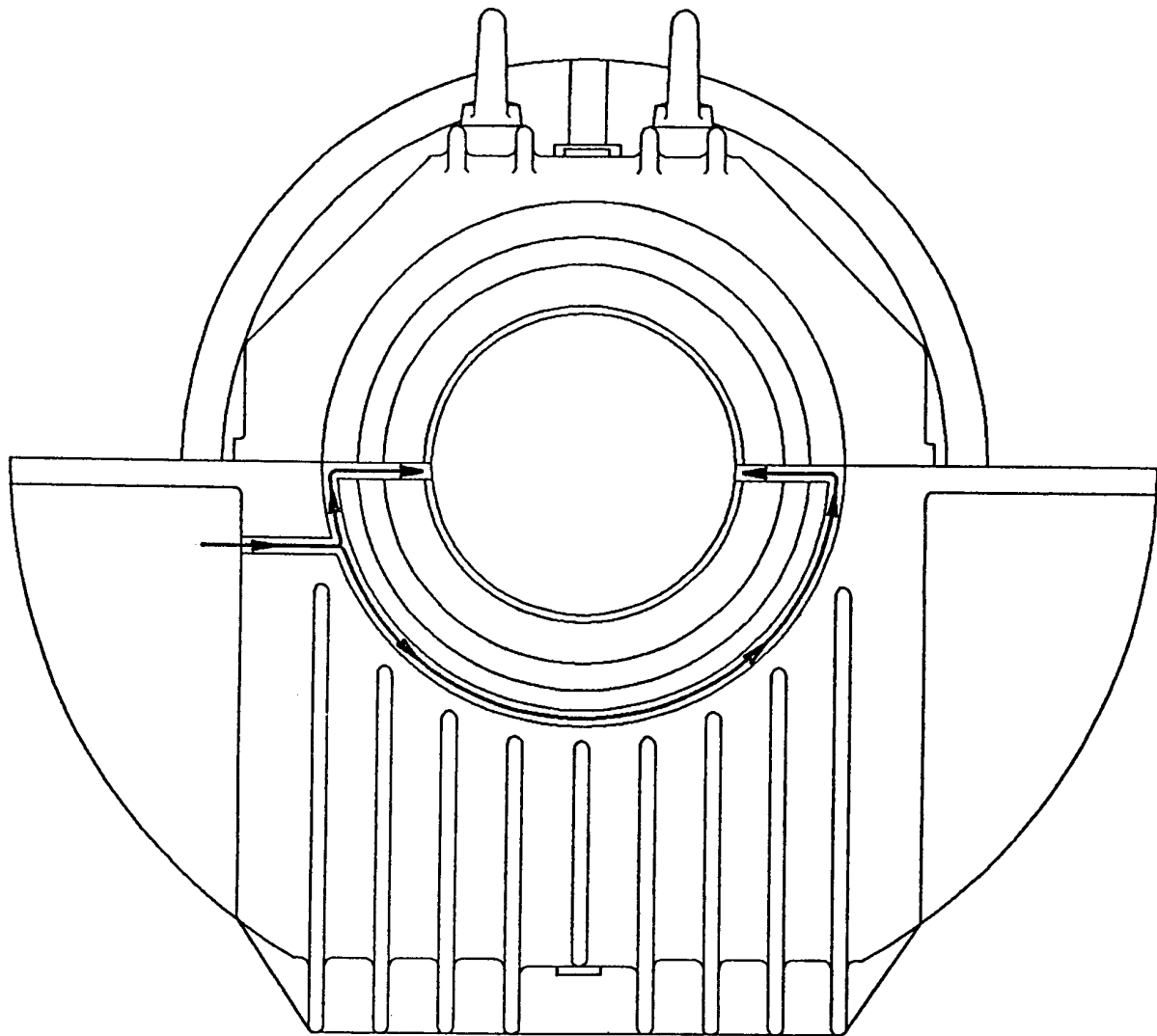
FIGURE 18 M 3

- 21A - INSULATED SPHERICAL SEAT
- 22A - INSULATED ANTI-ROTATION PIN
- 25 - END COVER



INSULATED BEARING
(SHOWN WITH END COVER)

FIGURE 18 M 4



OIL MAY ENTER HOUSING FROM EITHER SIDE

FLOOD LUBE OIL ROUTING

FIGURE 19 M 1

Measure Air Gap at Four Diameters at Each End
of Machine to Obtain Average.

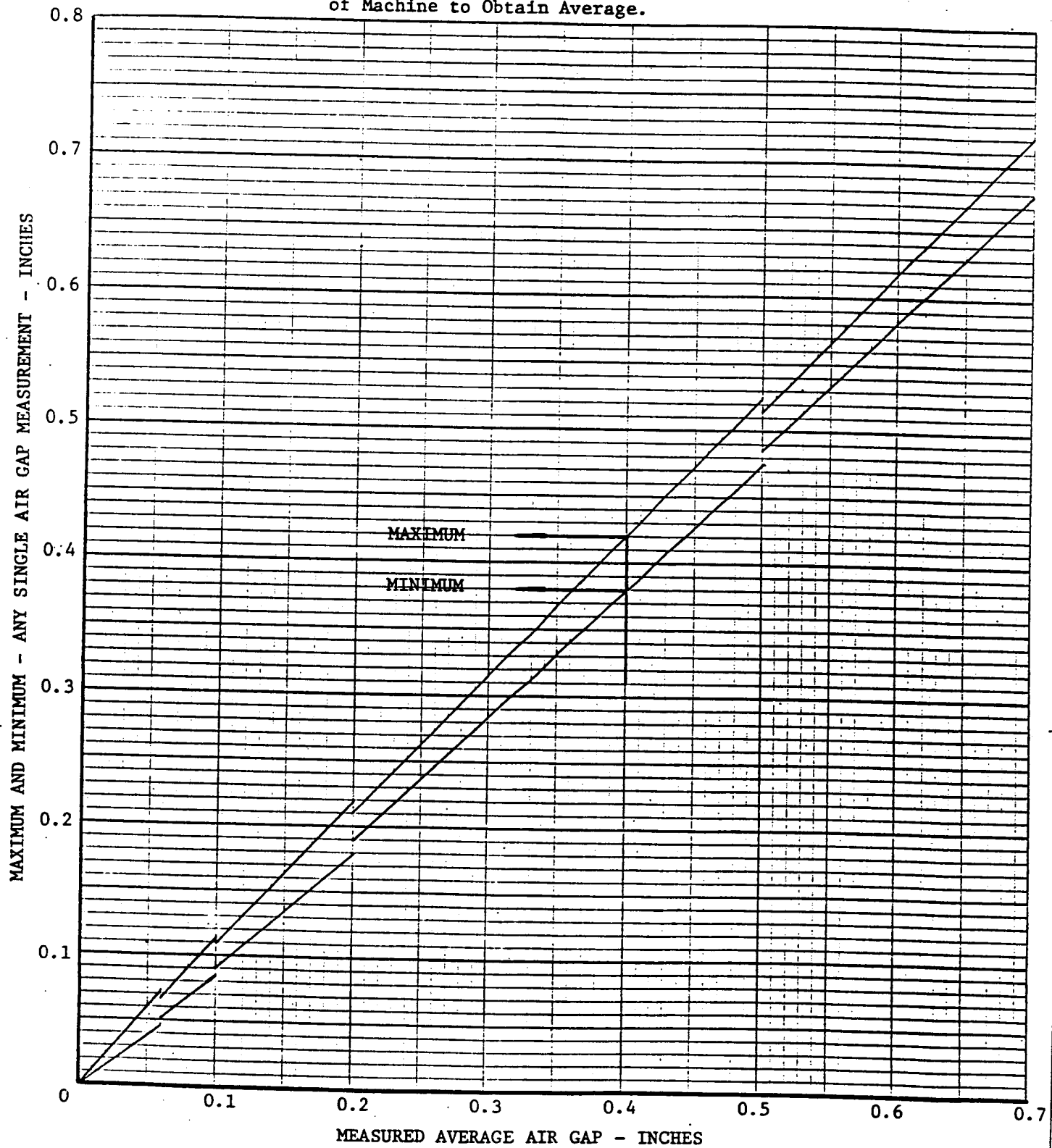


FIGURE 21

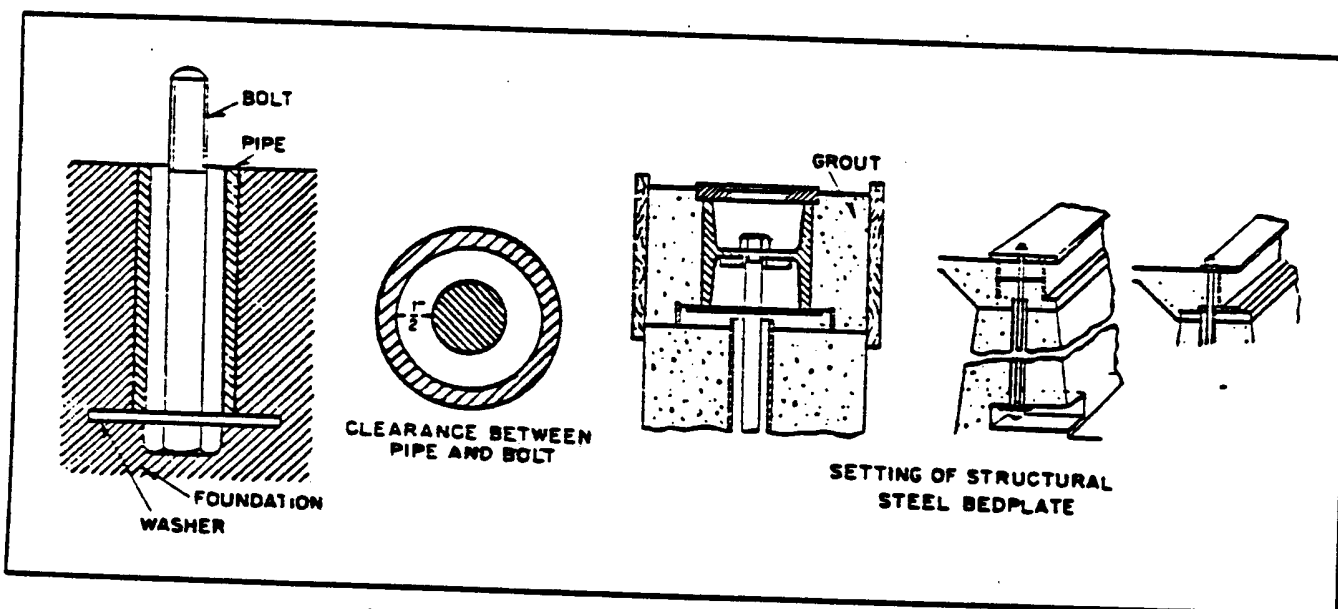


FIGURE 23

1. INSULATE CONNECTIONS BETWEEN MOTOR LEAD EXTENSIONS AND SURGE PAK LEADS WITH THE NUMBERS OF LAYERS OF ETHYLENE PROPYLENE RUBBER TAPE SPECIFIED IN THE TABLE BELOW. EXTEND THE TAPING TO OVERLAP EXISTING INSULATION THE MINIMUM DISTANCE SPECIFIED IN THE TABLE. HALF-LAP THE TAPE. APPLY TAPE WITH A SLIGHT TENSION (ENOUGH TO SECURE ABOUT A 20% ELONGATION). TAPE IS SELF-BONDING.
2. ALL OTHER CONNECTIONS INSIDE THE SURGE CABINET (CONNECTIONS TO LIGHTNING ARRESTORS, CAPACITORS, POTHEAD, CONNECTIONS BETWEEN NEUTRAL LEADS AND SHORTING BAR AND CONNECTIONS BETWEEN ASSEMBLED LEAD EXTENSION) ARE INSULATED AT THE FACTORY. IF ANY OF THESE CONNECTIONS HAVE BEEN LEFT UNINSULATED FOR ACCESSIBILITY TO OTHER COMPONENTS (FOR INSTANCE, CONNECTIONS TO SURGE CAPACITORS MAY NOT BE INSULATED TO ALLOW ACCESS TO A POTHEAD), INSULATE THESE CONNECTIONS PER THE ABOVE INSTRUCTIONS.

TABLE 1
INSULATION REQUIREMENTS FOR SURGE PAK ASSEMBLY CONNECTIONS

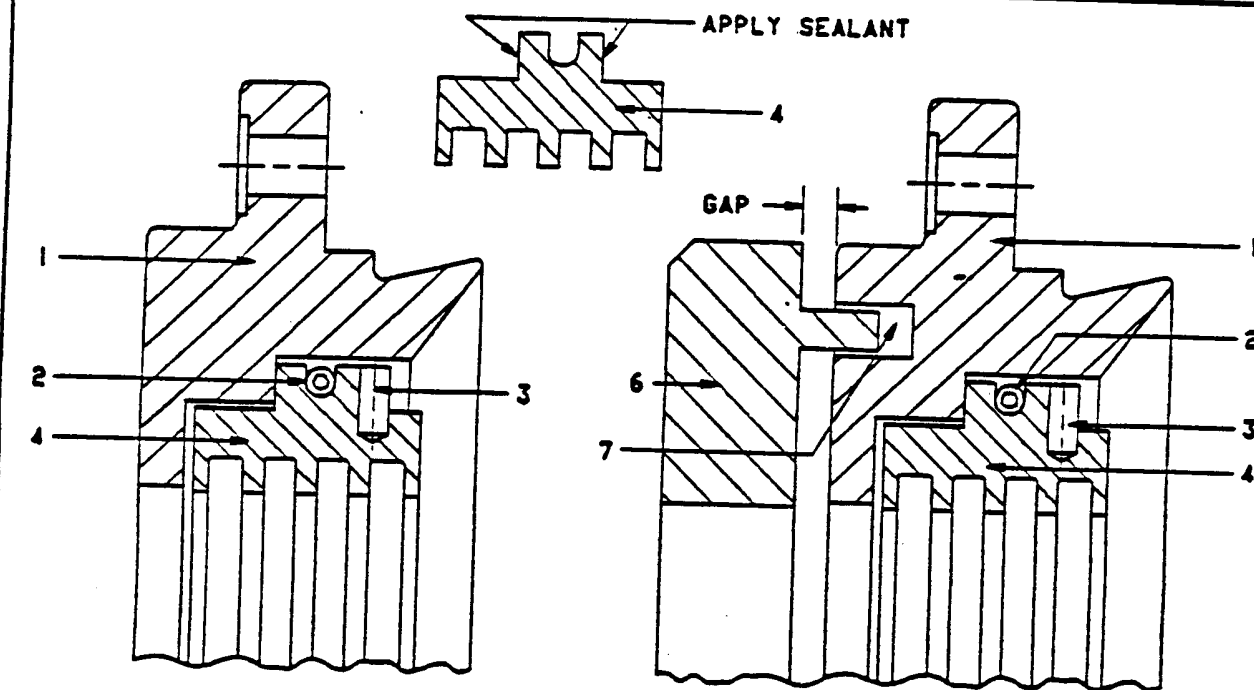
MOTOR OPERATING VOLTAGE	NO. OF LAYERS OF HALF LAPPED TAPE	OVERLAP EXISTING INSULATION. A MINIMUM OF
UP TO & INCL. 7000 VOLTS	3	1.5 IN
ABOVE 7000 VOLTS UP TO & INCL. 14500 VOLTS		2.5 IN

NOTE A: SEND PRINT OF THIS DWG PLUS INSULATING TAPE TO CUSTOMER WITH SURGE PAK. WHEN SURGE PAK IS SHIPPED SEPARATE FROM MOTOR.
NOTE B: 451515E IS SCOTCH 130 TAPE.

601- 3 CONNECTIONS UP TO & INCL. 7000 VOLTS. 3 10YD ROLLS
602- 3 CONNECTIONS UP TO & INCL. 7000 VOLTS. 4 10YD ROLLS
603- 6 CONNECTIONS UP TO & INCL. 7000 VOLTS. 6 10YD ROLLS
604- 6 CONNECTIONS OVER 7000 VOLTS UP TO & INCL. 14500 VOLTS. 8 10YD ROLLS
605- 9 CONNECTIONS UP TO & INCL. 7000 VOLTS. 9 10YD ROLLS
606- 9 CONNECTIONS OVER 7000 VOLTS UP TO & INCL. 14500 VOLTS. 12 10YD ROLLS
607- 12 CONNECTIONS UP TO & INCL. 7000 VOLTS. 12 10YD ROLLS
608- 12 CONNECTIONS OVER 7000 VOLTS UP TO & INCL. 14500 VOLTS. 16 10YD ROLLS

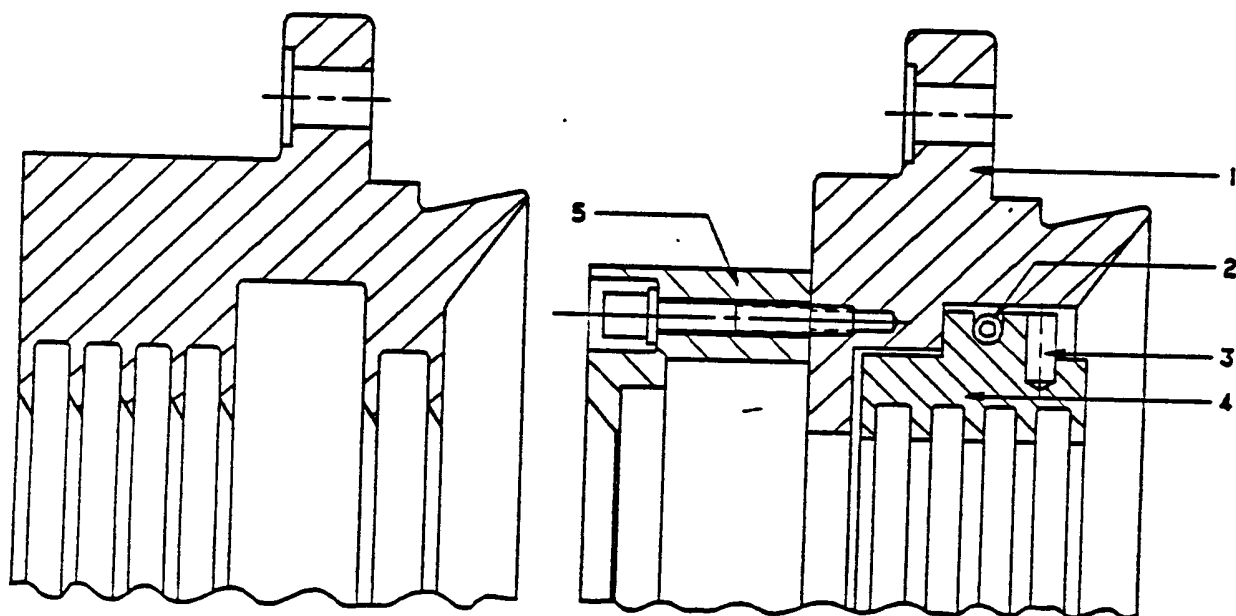
ENGINEERING NOTE: FIG 25

REV DATA		S.O. FUTURE D SPEC	
		ENG REF 704B482	
WESTINGHOUSE ELECTRIC CORPORATION			
TITLE LEAD CONNECTION INSULATION			
SURGE PAKS			
DIMENSIONS IN INCHES-SCALE NTS N CADAM DWG			
DFD P.E. TINNEY	0502083	APPD C.A. WILSON	051683
APPD L. SIMPSON	051083	APPD	
APPD J. BAZAR	051083	APPD T. KEGEL	052083
HEAVY INDUSTRY MOTOR DIVISION		ROUND ROCK, TEXAS	
		USA	
		REV NO 01	
		4313B98	



(A) TYPE 1 - FLOATING LABYRINTH
 IP 44 - DIRT AND SPLASH

(B) TYPE 2 - FLOATING LABYRINTH
 WITH ROTATING SEAL
 IP 54 - DUST AND SPLASH



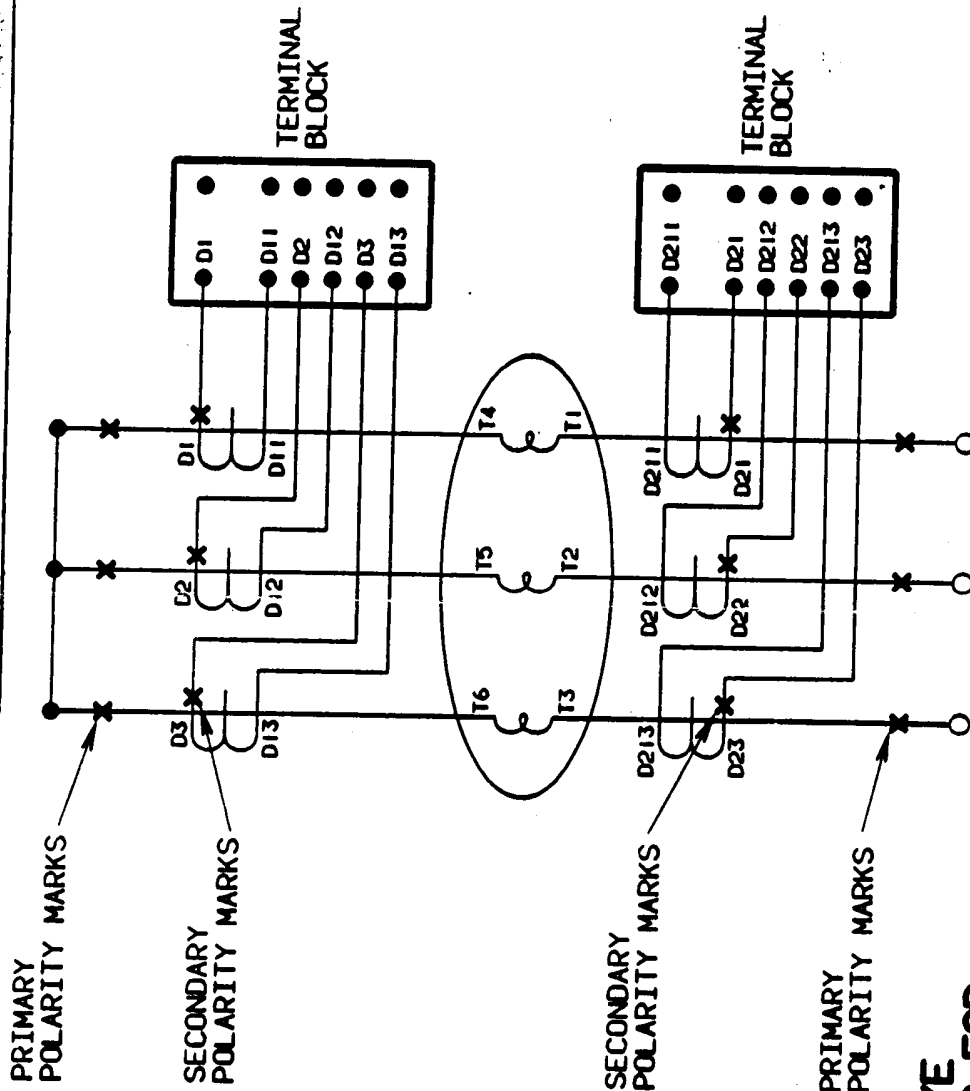
(C) TYPE 3 - FIXED LABYRINTH
 IP 44 - DIRT AND SPLASH

(D) TYPE 4 - FLOATING LABYRINTH
 WITH FIXED SEAL
 IP 55 - DUST AND SPRAY

1. SEAL CARRIER 2. GARTER SPRING 3. ANTI-ROTATION PIN
 4. FLOATING LABYRINTH SEAL 5. FIXED SEAL 6. ROTATING SEAL
 7. ROTATING SEAL GROOVE.

FIGURE 27 M 1

DRAWING 4A12529 REV. 01 TITLE SCHEMATIC-WYE CONN.
 SHEET 1 OF 1 ZONE PROT. DIFF. SCHEME
 S SMITH RETRIEVAL CODE

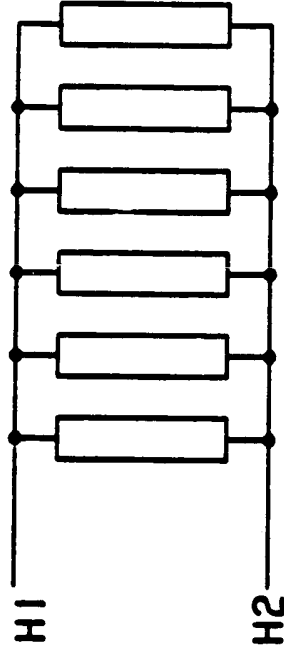


SCHEMATIC-WYE
 CONN. W/CT'S FOR
 ZONE PROTECTION
 DIFFERENTIAL SCHEME

REV DATA		S.O. 2372AA		REV	
		D SPEC 2372AA		01	
		DIMENSIONS IN INCHES - NTS			
		4A12529			

WESTINGHOUSE MOTOR COMPANY

ROUND ROCK, TX USA

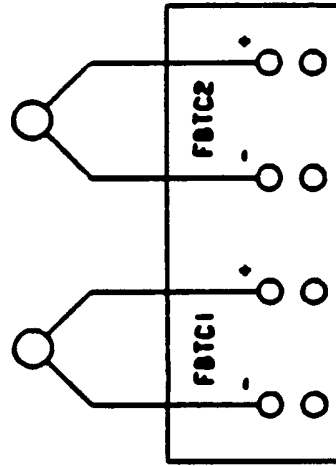


SPACE HEATER SCHEMATIC DIAGRAM

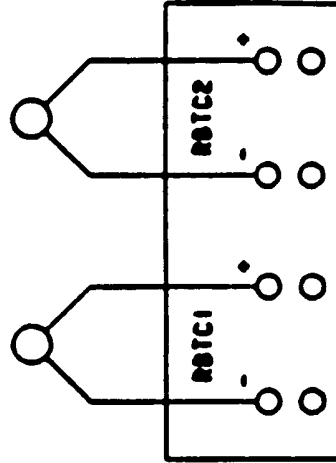
	DTN K. BROTHERTON	020401	S.O. FUTURE	REV
	APPD MC EACHTON	020501	D SPEC 110A30	01
	APPD	000001	DIMENSIONS IN INCHES - 010	
	APPD J. BROWN	020501	8627A09	

WESTINGHOUSE ELECTRIC CORPORATION HEAVY INDUSTRY MOTOR DIVISION ROUND ROCK, TX USA

THERMOCOUPLE COLOR CODE			
CHROMEL CONSTANTAN	(+) PURPLE	(-) RED	
IRON CONSTANTAN	(+) WHITE	(-) RED	
CHROMEL ALUMEL	(+) YELLOW	(-) RED	
COPPER CONSTANTAN	(+) BLUE	(-) RED	



FRONT BEARING

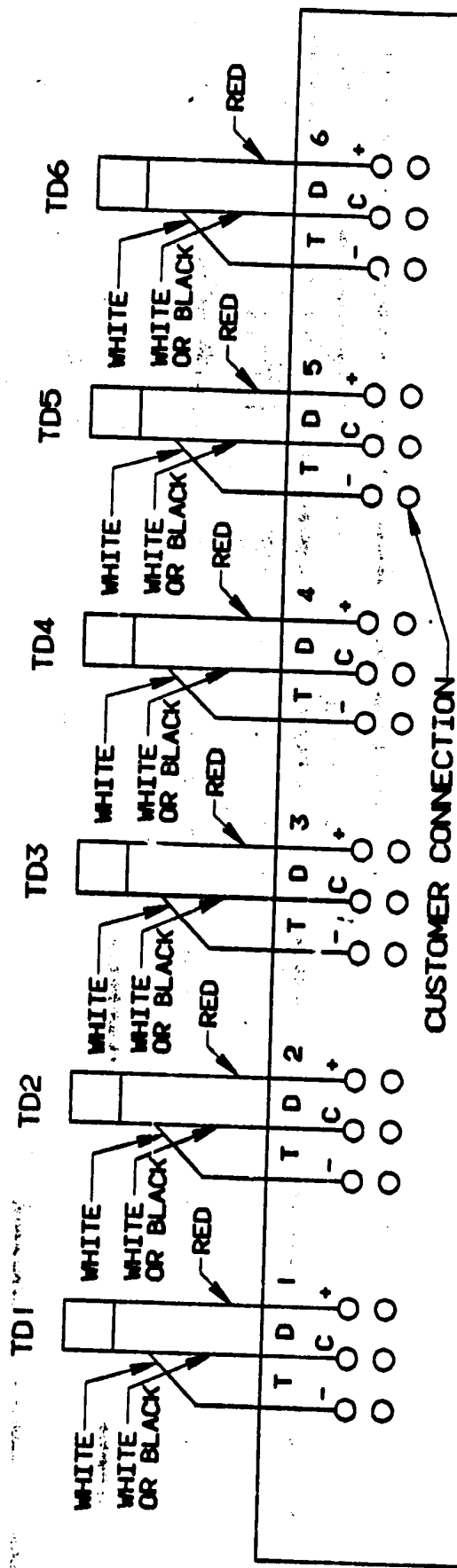


REAR BEARING

BEARING THERMOCOUPLE SCHEMATIC DIAGRAM (DUAL ELEMENT)

(DUAL ELEMENT) WAS (DUAL ELEMENT OR 2 PER BRG)		DTM R. CROSSOVER	111104	S. O. FUTURE	REV
		APPD D. REACTION	111100	D SPEC 110A36	04
		APPD	000000	DISTRIBUTION IN RECORDS - 010	
		APPD J. GREEN	111100	7903A57	

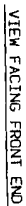
WESTINGHOUSE ELECTRIC CORPORATION HEAVY INDUSTRY MOTOR DIVISION ROUND ROCK, TX USA



3-LEAD

STATOR RESISTANCE TEMPERATURE DETECTOR SCHEMATIC DIAGRAM

R/N #R71418A: MADE COMMON LEAD "WHITE OR BLACK"	DFTM K. SMITH	103080	S.O. FUTURE	REV
KING. DEM. CONOMOS. BAZAR 101891	APPD D. MCEACHRON	103080	D SPEC 110A38	03
	APPD	M40080	DIMENSIONS IN INCHES - NTS	
	APPD J. BROWN	103080	7903A02	
WESTINGHOUSE ELECTRIC CORPORATION HEAVY INDUSTRY MOTOR DIVISION				
ROUND ROCK, TX USA				



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Instruction Manual

**TECO-Westinghouse Motor Company
5100 N. IH-35
Round Rock, TX 78681
1-800-451-8798**

**24 Hour Field Service Support
1-800-247-6859**

TECO-Westinghouse Motor Company

Operation and Maintenance Instructions

Instruction Book Number: 03124AA

Customer PO # 1-1493

MOTOR TYPE:	INDUCTION	APPLICATION:	Fan
TWMC SHOP ORDER:	03124AA	ENCLOSURE:	WP2
MOTOR CONFIGURATION:	Horizontal	BEARINGS:	Sleeve Bearings
POWER RATING:	1750 Hp	VOLTAGE:	4000

4/9/2010

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1.0 General

This manual provides descriptions, recommendations and instructions for receiving, storing, handling, installing, operating and maintaining Horizontal Induction Motors. It is recommended that this manual be read in its entirety before any of the afore mentioned procedures are conducted.

Specific information relating to operation and rating may be found on the motor nameplates and tags. Dimensions and information required for foundation, main and auxiliary electrical connection, and driven equipment interfaces may be found on the motor outline drawing. It is important to review carefully the outline and all warnings, notes, and nameplate information related to this equipment.

Prior to storage of any apparatus or components thereof, read carefully all tags affixed to equipment or parts or crating and follow instructions fully. In addition, segregate all parts, by shop order number, for orders with multiple motors.

The major components of the motors are:

- Frame and Stator Assembly
- Bearing Bracket
- Bearings
- Rotor Assembly
- Ventilation Enclosure

For the manufacturer's warranty on this motor to be in effect, the equipment must be installed in strict accordance with the outline drawing and this instruction book. For answers to any questions about storage or installation call 1-888-754-5006 Customer Service (M-F 8:00 through 4:30 cst).

It is recommended that frequent and careful references be made to the figures, pictures, etc. included, as a valuable aid in understanding and using this manual. All possible contingencies, which may arise during the installation, operation, or maintenance of this equipment, do not claim to be covered by these instructions.

2.0 Handling

2.1 Shipment and Receiving

The motors on this contract were packaged for shipment from the factory consistent with the carrier type and method of shipment. Even though precautions were taken to protect the motor against damage in transit, unusual transport events can not be anticipated. Inspect the packaging for any signs of damage and or missing components. If any shortages exist, or if there is any evidence of damage, notify the carrier and the nearest TECO-Westinghouse Sales Office. It is advisable to unpack damaged equipment in the presence of a representative of the carrier. If unnoticed damage is discovered later, notify the carrier immediately and request an inspection before proceeding with the installation. In any correspondence with TECO-Westinghouse, it is imperative to include all data stamped on the rating nameplate including both the style and serial numbers.

Consult the outline drawing and/or shipping invoice to determine what items are to be received and verify that all were delivered and are in good condition.

2.2 Unpacking

After shipment has been received and inspected, the following should be conducted and checked during the unpacking of the motor:

- Remove all packing material
- Clean any slushing compound from the shaft extension or coupling with a petroleum solvent



WARNING: Observe all required safety precautions when using petroleum solvents

- Inspect the motor and any auxiliary devices shipped separately

Equipment that cannot be installed upon receipt should be unpacked, examined, and stored in an enclosed location. This location should be clean, dry, and temperature controlled. (See Start Up and Storage Sections)

2.3 Lifting and Handling

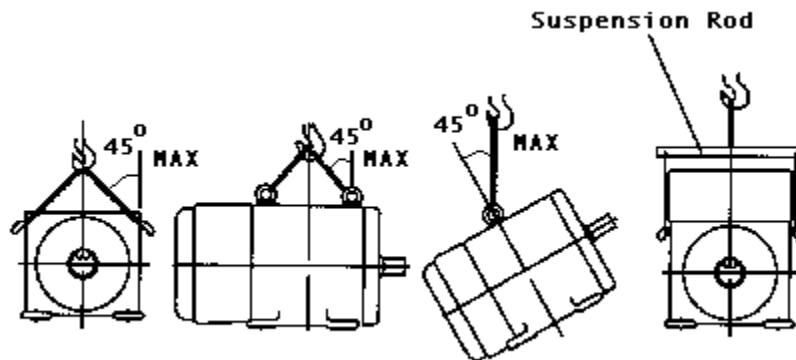
All lifting should be done using the lifting points that have been provided. (See the outline drawing for the location, size, configuration, and for the total motor weight.) Arrange any slings, chains, or cables so that the weight is distributed uniformly. Use spreader bars when necessary to avoid undue pressure on light sheet metal parts of the motor.

It is possible, by rough handling or careless use of bars or hooks, to do more damage to a motor before or during installation than would occur during operation.

If the motor is to be set in a temporary location, lower the motor, or components, onto supports that are reasonably level, using the original packing materials or provide new ones to protect the motors from the environment.

- A four-leg chain, or sling of suitable load rating and with legs as long as possible, is required. The angle between any leg and the horizontal must be 30 degrees or greater if spreader bars are not used.

If a heavy coupling or other attachments unbalance the load, additional slings should be used to level the lift.



2.4 Shipping Brace

A yellow shipping brace designed to prevent motion of the rotor during transit has been supplied and should be installed at all times when the motor is being moved. Failure to utilize this brace could result in damage due to axial movement of the rotor. The shipping brace should be retained for future dismantling.

3.0 Storage

3.1 General Storage

If at all possible, the motor should be stored under cover in a clean, dry location. In situations where a storage location is subject to cold or damp environments, or severe humidity changes, the motor can be protected against condensation and moisture absorption by maintaining the temperature of the stator windings a few degrees above the ambient temperature. This may be accomplished by energizing the space heaters.

Cover the motor with a tarpaulin to protect it against construction or wind blown dust, plastic covers are not recommended.

Measuring the insulation resistance at monthly intervals can check the effectiveness of the storage protection. A significant change in the insulation resistance is usually indicative of moisture absorption and should be investigated. Refer to the Inspection and Maintenance section of this manual for this procedure.

During factory testing, motors with oil lubricated bearings are operated with a rust-inhibiting oil in the lubrication system. The oil is drained from the bearing reservoirs prior to shipment, but a protective film remains on the bearings and shaft journals. It is recommended that immediately upon receipt, the bearing reservoirs should be filled to the proper level with rust-inhibiting oil. On a monthly basis (or more frequently if the location is damp and subject to temperature changes that might produce condensation) rotate the shaft several revolutions while pushing it through the limits of its endplay.

WARNING: The Shipping brace must be removed before energizing the motor, or while rotating the shaft in storage, and it must be replaced when moving the motor from storage to its final location.

3.2 Off Site Storage

If the motor is removed from its installed location, to be stored elsewhere for a time period greater than one month, the following is recommended:

-
- Coat all bare metal surfaces with a rust protective coating.
 - Locate the original shipping braces and install them. If the original braces cannot be found, fabricate a brace for the motor on the principle that the brace must pull the rotor to one extreme position of its total end float and hold the rotor there during the impacts that it might experience in handling and transit.
 - Store the motor as previously described in this manual.
 - Reactivate the motor as described in this manual.

4.0 Pre-Installation

4.1 Pre-Installation Procedures

The installation of this motor requires great care and attention to detail, because subsequent successful performance of the motor will depend, to a great extent, on its alignment to the driven equipment and the rigidity of the foundation. Before beginning installation the following points should be checked and verified to avoid future operating problems:

- Inventory all items on-site against the manufacturer's shipping report. Missing items or signs of damage should be reported immediately to avoid undue delay in construction
- Locate foundation benchmarks to establish the centerline of the unit and the elevation of the foundation surface
- Check the foundation against the outline drawing of the motor to ensure that all of the motor interface details have been provided and are in the correct location

In addition, the following should also be considered:

- The motor installation and all electrical connections must meet all requirements of the National Electric Code and all local codes and regulations. Install the motor in a well-ventilated area, not subject to ambient temperatures greater than 40 °C or elevation greater than 3300 feet. Note the direction of the inlet and exhaust air, and take the necessary precautions to prevent air re-circulation from the exhaust to the inlet or from the hot discharge air from one motor directly entering the intake of another
- Assure that there is sufficient working space around the motor for disassembly, cleaning, inspection etc
- Sleeve bearing motors with oil ring lubrication must be mounted with the shaft in a horizontal position to prevent oil leakage and insure proper oil ring performance.
- Ensure that any plugs covering the equalization ports on sleeve bearings are removed. If these plugs are not removed oil from inside the bearing housing may be drawn into the interior of the motor.



WARNING: Special precautions should be taken where the installation environment is such that any sparks from the motor may cause combustibles to ignite.

4.2 Foundation

A rigid foundation is essential to reduce vibration and misalignment during operation to a minimum.

- An engineer, who is familiar with foundation design should design and supervise this part of the installation.

Refer to the outline drawing for all motor/foundation interface dimensions. It is essential that the motor foot mounting surfaces rest on a steel pad or plate regardless of the type of foundation. The top surface of the steel pads or plates must form a level plane at an elevation slightly less than the maximum dimension from the motor shaft centerline to the mounting foot surface. This is necessary to allow addition of shims between the motor feet and steel-mounting surface to obtain final alignment with the driven equipment. It is much easier to raise the motor with shims than to remove foundation if the final elevation is too high.

4.3 Shims

Shims should be made from steel stock as follows:

- The shims should be as large as the width of the frame foot in both directions (see outline drawing for foot mounting, or bearing surface dimensions.)
- The shims should be slotted to the proper depth to clear dowel guide holes and tapped jackscrew holes in the motor feet (see outline drawing for hole location and sizes). This allows easy shim insertion or removal during alignment.
- Shims must not have burrs on cut edges, particularly around the slots previously described to clear dowel and jackscrew holes, or on the outer shim edges, if they are the same dimension as the mounting band of the foot.

Suggested method of installing shims between the motor and the foundation is:

- Set the motor on the steel foundation surface approximately at its final aligned position. Assure that hold-down bolts will go through the holes in the motor feet and properly engage threaded parts. Be certain that the shipping braces and their hardware (painted yellow) are removed.
- Before any vertical alignment changes are attempted, measure any gaps between all foot mounting surfaces and the foundation with feeler gauges to the smallest shim thickness available or to within .002 inch. Record the measurements, location, and depth of penetration of the feeler gauge from the outer side of each foot mounting pad. Make an initial set of shims from these measurements of the required thickness with length equal to measured feeler penetration plus .5 inch. Insert each shim in the proper location and bend up the projecting edge

against the side of the motor foot to permanently mark its depth position and to facilitate handling of the shims.

- After all initial shims have been made and installed, proceed with alignment adjustments of the motor. Keep the initial shims in the same location and on top of any additional shims required.
- Shims added to obtain final alignment should be the smallest possible number of thick shims rather than a large quantity of thin shims. A general guideline is that shim stacks of .06 inch or more should be replaced with a single shim of the same thickness.

The operational vibration performance of the motor is directly affected by the rigidity of the foundation and the degree of precision of its contact with the foundation.

4.4 Alignment

The motor should be set on its foundation as close to the final aligned position as possible. The preliminary shims described in the previous section should be in position. The rotor of the motor should be positioned at magnetic center. When the motor has been positioned correctly, install and tighten the hold down bolts. The motor is now ready for angular and offset alignment checks.

Angular alignment is checked by measuring the space between coupling faces with a feeler gauge at the top, the bottom, and both sides. The readings should all be taken at a uniform radius from the shaft center and at the largest possible diameter. Both shafts (motor and driven equipment) should then be rotated together and the gap at each 90-degree position re-measured. This will assure an accurate check on the angular relationship between the axis of the shafts independent of any axial runout.

The right and left side component of angularity can be corrected by shifting the motor on the foundation. The top and bottom component of angularity can be corrected by adding shims under the feet of the motor, or driven equipment.

Offset alignment is checked by mounting a dial indicator on one coupling half so that the indicator stem reads radially on the periphery of the other coupling half. The position of the indicator stem should be marked on the surface of the half coupling and all subsequent readings should be taken with the indicator stem in this position. The two shafts are rotated together through 360°; the indicator reading should repeat the initial setting. If it does not, the results are not valid and should be repeated after checking the tightness of the indicator mounting.

The hold-down bolts should be loosened and the motor shifted and shimmed as required to correct the angular and offset alignment. The correction should be checked after all shims are added and the hold-down bolts re-tightened. If jackscrews are used to shift or lift the motor, be sure that they are unloaded before any alignment checks are made. Jackscrews are not intended to be permanent supports.

CAUTION: While some flexible couplings can tolerate considerable misalignment, even a few thousandths of an inch misalignment can introduce large vibrational forces into the system. To obtain maximum bearing life and minimum vibration, align the units as closely as possible and check the hot alignment condition

After the final alignment has been obtained, it is recommended that dowels be installed through the motor into the foundation. This will maintain the alignment and facilitate re-installation of the motor if it is removed from its location for any reason. Lead holes for the dowel have been provided to facilitate drilling and reaming.

The motor shaft and driven shaft should be aligned within the following tolerances in both angular and parallel alignment. The table below provides the alignment tolerances:

Units: mm/in

TIR	Speed Range	Solid Coupling	Flexible Coupling
C	Below 2500 rpm	0.03/0.0011	0.03/0.0011
A	Below 2500 rpm	0.03/0.0011	0.04/0.0015

Angular misalignment is the amount by which the centerlines of the driver and driven shafts are skewed. It can be measured using a dial indicator set up as shown in the figure below. The couplings are rotated together through 360 degrees in order that the indicator does not measure runout of the coupling hub face. The shafts should be forced against either the in or out extreme of their end float while being rotated.

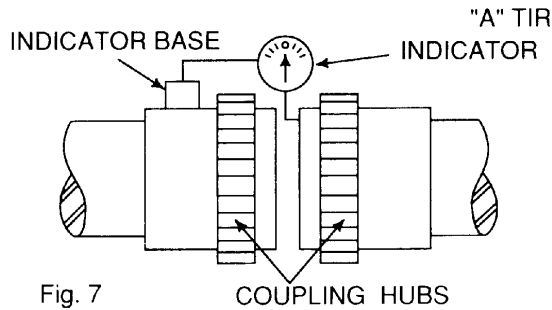


Fig. 7
TIR=Total indicator reading (by dial indicator)

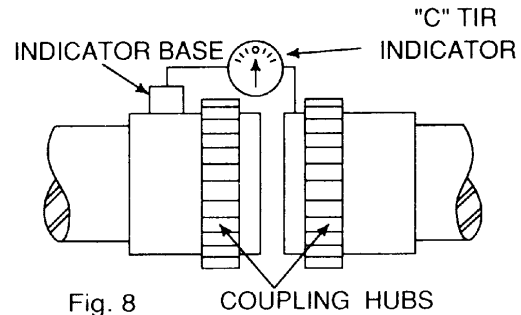


Fig. 8

Parallel misalignment is the amount by which the centerlines of the driver and driven shafts are out of parallel. It can be measured using a dial indicator set up as shown in the figure above. Again, the couplings are rotated together through 360 degrees so that the indicator does not measure runout of the coupling hub outside diameter.

4.5 Realignment

If there is occasion to align the unit again after dismantling, a satisfactory alignment should be obtained by returning the motor to the positions indicated by the dowel holes. The thickness of the shims used should be the same as in the original installation. Nevertheless, the coupling alignment and level should be rechecked before the motor is returned to operation.

In general, the axial shaft growth for motors can be disregarded since neither bearing is fixed and any shaft growth due to temperature increase will produce an elongation away from the coupling.

Shaft height growth (the change in shaft centerline elevation) can be calculated as follows:

$$\Delta = \frac{0.0005\text{in} * (\text{Motor foot to centerline of shaft})}{2}$$

4.6 Coupling Installation

Field application of a coupling to the motor should follow the procedures recommended by the coupling manufacture. The motor shaft extension must not be subjected to either extreme heat or cold during the installation of the coupling. The coupling should be pressed onto the shaft extension with slight axial force.

**ATTENTION: DO NOT HAMMER A COUPLING ONTO THE SHAFT.
THIS MAY RESULT IN DAMAGE TO THE BEARINGS.**

The shaft key may be stepped and a radius provided to eliminate potential balance problems, but under no circumstances may the motor be modified without the approval of TECO-Westinghouse Motor Company.

5.0 Start Up

5.1 Connections

Motor control wiring, overload protection and grounding should be done in accordance with the National Electrical Code and all local requirements.



WARNING: The motor frame should be properly grounded to protect personnel against danger from electrical shock. A ground connector should be bolted to the grounding pad, welded to the frame beside the frame foot. Remove all paint before bolting the ground connector in place. Also see NEMA MG2-3.15.

Refer to the outline drawing for the main power, auxiliary instrument terminal location, and marking and for their schematic diagram part numbers.

5.2 Initial Start – Uncoupled

An initial start is considered to occur when the motor is first energized after initial installation, major maintenance, or extended periods of inactivity. It is recommended that the initial start be made with the motor uncoupled from the load. The following inspections are recommended:

- Verify that all installation and maintenance work is complete and that all shipping braces and all protective coverings have been removed.
- Check the bearings to ensure that all reservoirs are filled to the proper level with the correct lubricant. Refer to the lubrication nameplate on the motor and/or the outline drawing for lubrication recommendations.
- Before the power leads are connected to the motor, the insulation resistance of the winding should be measured to ensure it is suitable for operations. Refer to the Inspection and Maintenance Section for a description of the insulation resistance measurement procedure and for methods of interpreting the results and suggestions for corrective action.

CAUTION: If the motor leads (with or without terminals) are cut or shortened, examine and carefully clean the cable strands of resin before applying the new terminals.

Check and verify the following:

- The power supply is of correct voltage, frequency and phase sequence. Refer to the outline drawing or the nameplates on the motor.
- The motor control equipment has been installed in accordance with its instructions.
- De-energize the space heaters.
- Check out the electrical circuits; a list of schematic drawings can be found on the outline drawing.
- Check the controls to make sure that the motor can be stopped before it is started.

This motor has been designed for bi-directional rotation. Refer to the outline drawing or motor nameplates for the phase sequence and line lead orientation. To change the direction of shaft rotation, interchange any two of the three power leads. Verify that the direction of rotation is correct for the driven equipment.

NOTE: Motors with directional blowers can, in most instances, be changed to obtain shaft rotation in the opposite direction by switching the blowers end for end and re-balancing the rotor. Refer to the nearest TECO-Westinghouse Sales Office for assistance.

- All construction dirt must be removed from the motor. If compressed air is used to blow out the motor, the air must be clean and dry and not exceed 30-psi pressure
- Inspect all electrical connections for correct termination, clearance, mechanical strength, and electrical continuity. Check the connections of the auxiliary motor equipment.
- Recheck the voltage and the number of phases of the space heaters with that shown on the outline drawing
- Turn the rotor with suitable hand tools and verify that it rotates freely, and listen for any signs of rubbing against foreign objects in the air gap, or stationary parts. Also check the oil rings through the sight window to be sure they are turning freely.
- Push the rotor toward the driven equipment to the limit of the rotor end float to verify that the motor half will clear the coupling half of the driven equipment in this position.

WARNING: Do not attempt an uncoupled start if coupling interference cannot be remedied.

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- Replace all covers and other components that were removed for inspection purposes. Be certain that all protective devices and all monitoring equipment are connected and will function properly.
 - Ensure that all personnel are safely clear of the rotating parts.
 - Close the main breakers.
 - Bump the motor electrically (push the start control button, allow the motor to accelerate to running speed and then push the stop control button) to check for the correct direction of shaft rotation.
 - After the rotor has coasted to a standstill, de-energize the power supply and make any necessary power lead connection changes required to correct the direction of rotation. Reinsulate any changed connections.
 - Re-start the motor and allow it to run. Check the bearing temperature frequently, especially during the first two hours of operation. In this period of time, the rate of bearing temperature rise is more indicative of trouble than the absolute bearing temperature. If the rate of bearing temperature rise appears excessive shut the motor down and inspect the bearings. Under normal operating conditions, the rate of temperature rise should be from 11°C to 14°C for the first ten minutes of operation after start up, and approximately 22°C at thirty minutes. The rate of bearing temperature rise is a function of the natural ventilation and operating conditions. When the rate of bearing rise is less than 1°C per half-hour, the bearing temperature is considered stabilized.
 - It is recommended that records be kept of the steady state uncoupled vibration and bearing temperatures to use for comparison with coupled and loaded running conditions, and to provide a data base for judging the motor's performance in the future. These records should be permanently retained for reference.

5.3 Initial Start – Coupled to Load

- Remove any bracing that may have been used to support and center the coupling shell. Lubricate and assemble the coupling halves in accordance with the coupling manufacturer's instructions. Note any match marks on the couplings and be sure to make the assembly according to match marks, if they exist.
- Ensure that all personnel are at a safe distance from rotating parts. Start the motor in accordance with the instructions supplied with the motor control.

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- If the motor rotor fails to start turning or fails to reach full speed shut off the power supply immediately. Refer to the Trouble Shooting Section if either of these two conditions exist
 - Note that motor vibration may not be identical to the uncoupled values. If coupled vibration is excessive, recheck the mounting and alignment, also see Trouble Shooting.

5.4 Routine Starts

It is recommended that a routine check of motor operation, as described in the preceding section, be made immediately after each routine start. Do not exceed the limits of starting duty stated on the starting limit or the temperature limits stamped on the rating nameplate.

5.5 Starting Duty

CAUTION: Frequent starting may result in serious damage to the motor windings or to the rotor. To prevent damage to the motor, the maximum starting duty as stated on the motor nameplate should not be exceeded.

CAUTION: Repeated starts and/or jogs greatly reduce the life of the stator windings or the rotor cage due to the high forces and heating. Jogs, or rapid starts in succession should be avoided. Instead, start the motor and allow it to accelerate to full speed before de-energizing.

5.6 Inactivation

If the motor is taken out of service for a time period greater than one month, but will be left on the foundation coupled to the driven equipment, the following is recommended:

- Drain the oil and replace it with clean rust-inhibiting oil. On a monthly basis (or more frequently if the location is damp and subject to temperature changes that might produce condensation) rotate the shaft several revolutions while pushing it through the limits of its endplay.
- To prevent stator winding insulation degradation, keep the internal stator temperature above the outside ambient temperature by a few degrees.
- If the storage location is not hermetically controlled, coat all bare metal with a rust protective coating.
- Be sure to tag all control and power equipment for the motor with warning tags indicating what was done and what is required before any start can be made.
- To reactivate the motor, repeat the procedures in the Start Up section.

6.0 Maintenance and Inspection

6.1 Introduction

To insure continuous service, it is necessary that an inspection and maintenance program be initiated that will detect malfunctions before they become major problems. The following suggestions are guidelines to establishing an effective preventive maintenance program.



WARNING: To avoid personal injury and before servicing the motor or touching any internal parts, all power sources to the motor and its auxiliaries should be disconnected and de-energized. All rotating parts should be at a standstill. The frame of the motor must be grounded properly to avoid severe injury to personnel. Only trained personnel in accordance with the National Electric Code, all local codes, NEMA Safety Standard MG 2, and after reading the TECO-Westinghouse Instruction Book should perform installation and servicing of this motor. See the outline drawing for any special assembly instructions and for the locating of lifting points and special handling instructions. Lifting devices mounted on individual parts are intended for lifting the individual part only. Lifting slings must not put excessive side thrust on the lifting device.

6.2 Machine Test Reports

TECO-Westinghouse has provided an official test report for this equipment as it performed in the TWMC factory test facility. This data represents the “as new condition of the motor” and should be retained for future reference when performing maintenance on the supplied motors.

6.3 Routine Inspection of Operating Motors

TECO-Westinghouse strongly recommends that the lubrication system be inspected regularly. Verify that the oil level in all gauges is at the correct level and that the oil rings are rotating freely. An inspection window located at the top of the bearing cap has been provided for this inspection. If any oil leakage is noted, it should be traced to the source and corrected. Inspect for lubricating oil discoloration or contamination and note any sudden changes in noise or vibration and make

corrections quickly. Bearing temperatures should be recorded periodically during continuous operation, so that changes will be apparent and corrective action can be taken.

6.4 Routine Maintenance Inspections

The motor should be inspected annually. Unusual service conditions that might justify semiannual maintenance are:

- Exposure to:
 - Abrasive or electrically conducting dusts.
 - Very dirty conditions around the motor where the accumulation of dirt will interfere with normal ventilation.
 - Chemical fumes, steam, salt laden air, or oil vapor.
 - Damp or very dry locations, radiant heat, vermin infestation, or atmospheres conducive to the growth of fungus.
 - Abnormal shock, vibration, or mechanical loading from external sources.
- Operation where:
 - There is excessive departure from rated voltage and/or frequency (see NEMA MG2-3.06).
 - The location is poorly ventilated or the ambient air temperature exceeds the value stamped on the rating nameplate.
 - The motor is subjected to torsional impact loads, repetitive overloads, electric reversing or braking or long accelerating times due to high load inertia.

The following maintenance activities are recommended:

- Drain, flush, and re-lubricate the bearings. Inspect the bearings and the lubrication system if any unusual conditions have been previously noted. Refer to the Bearing Section for inspection procedures and to the outline drawing for the lubrication recommendations.
- Take corrective action for any signs of oil leakage
- Remove the frame end covers and inspect the interior of the motor for evidence of condensation, water accumulation, rust, or corrosion, dirt or other foreign material. Remove general dirt and dust as described in the Maintenance Section of this manual. Look for signs of overheating, particularly the stator insulation, as evidenced by blistering, discoloration, or charring. Inspect all insulated electrical connections for tightness, for frayed or damaged insulation, cracked varnish or coil movement. Measure the stator winding insulation resistance as described herein.

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- Inspect all nuts and bolts to ensure that they are tight. This is particularly important for fasteners on the rotor or fasteners that could fall into the rotor if loosened.

A permanent record should be kept of the dates and conditions observed during periodic inspections. These records will provide a useful reference for future maintenance.

6.5 Inspection and Cleaning of Stator Windings

The motor windings can be easily inspected upon removal of their protective covers. In order to completely inspect and clean the windings, it is necessary to remove the rotor from the stator. Any one of the several methods described herein may be utilized to clean the windings. The most effective method depends upon the kind and amount of dirt lodged on the windings. The methods, which may be used, are listed below in order of preference.

NOTE: Before cleaning the windings, inspect them for loose wedges or spacers, evidence of damage to the insulation, distortion or movement of the coils, etc. If any of these conditions exist, contact TECO-Westinghouse Field Service Department for assistance.

Dry-Wiping

Cleaning by wiping with a clean, dry, lintless cloth may be satisfactory when the surfaces to be cleaned are accessible and when only dry dirt is to be removed. Lint is particularly damaging on high-voltage insulation, as it tends to cause concentrations of corona discharge.

Brushing and Suction Cleaning

Dry dust and dirt may be removed by brushing with soft bristle brushes, followed by vacuum suction cleaning. (Do not use wire brushes.) This is a desirable method because the dirt is not scattered and does not settle on other apparatus.

Blowing

Blowing out dirt with a jet of air should only be done to remove dirt from inaccessible areas and only when the motor is dry. Avoid directing the air in such a way that the dirt will be blown into inner recesses from which it would be difficult to remove and where it might clog vent ducts.

WARNING: Do not use air pressures greater than 30 psi in order to avoid damaging the insulation and to prevent dirt from being blown under loosened insulation. Be certain that the air is dry and does not contain water from condensation in the air-lines.

Solvent Cleaning

Solvent cleaning is particularly effective for removing tar, grease, wax, and oil from electrical apparatus. The surfaces can be wiped with a cloth wetted with the solvent, followed by wiping with a dry cloth.

TECO-Westinghouse recommends that solvents such as Stoddard solvent, mineral spirits, or comparable petroleum solvents be used for cleaning insulation whenever possible. In fire-hazardous areas, inhibited methyl chloroform may be used. While this solvent is not flammable under ordinary conditions, it is moderately toxic. Therefore, local exhaust ventilation is necessary if the odor of solvent vapors is very noticeable.

WARNING: When working with solvents, always provide adequate ventilation in order to avoid fire, explosion, and health hazards. Evaluate any confined areas. Based on a hazard analysis, the operators should wear the appropriate personal protective equipment. Solvents should always be stored in safety cans. Always keep open flames and sparks from flammable solvents away and their vapors.

WARNING: Do not use solvents on windings with elastomeric coating for abrasive conditions.

Water, Emulsion, and Alkali Cleaning

Motors may be cleaned by hose washing, by pressure spraying from a steam generator, steam from a shop line, or from a spray of hot water and compressed air. The jet pressure and temperature should not exceed 30-psi and 80°C (176°F), respectively, when cleaning insulation.

It is necessary to add a nonconductive detergent compound to the water for removal of tar, wax, grease, or oil from insulation. These compounds contain non-ionic emulsifying agents. Some

known as emulsion cleaners also contain solvents to soften the hard deposits so that they can be more easily washed off. These compounds are not electrical conductors and are safe on insulation.

NOTE: If the insulation shows signs of dryness, clean and re-varnish the windings, preferably under the guidance of TECO-Westinghouse Field Service Engineers.

Cleaning of Air Filters

Remove the filters from their holders. Reusable filters may be cleaned by hosing the fine-mesh side with hot water, or by agitation (fine-mesh face down) in a solution of Oakite No. 20 (3 pounds to 5 gallons of water), trisodium phosphate (1 1/2 pounds to 5 gallons of water), or other suitable cleaning compounds. Never use caustic soda or other strong alkalies. If more convenient, the filter may be boiled (fine-mesh face down) for five minutes in one of the cleaning solutions mentioned. After cleaning, look through the filter toward a bright light; no cloudy areas will be seen if the filter has been thoroughly cleaned. It is not necessary to wash the blackened oil coating from the wire.

Before the air filters are replaced, they must be properly charged with the correct adhesive; commercial adhesives (such as Air-Maze Filterkote) or SAE 30-50 motor oil may be used for this purpose. Charging may be accomplished by dipping the filter in the adhesive, spraying it thoroughly with a power-spray gun, or by liberally coating both sides by means of a brush. After charging, allow the filters to drain thoroughly face down or on edge over a suitable receptacle. When excess adhesive has drained off, replace the filters.

6.6 Insulation Resistance

An insulation resistance test measures the current that flows over and through the surfaces and insulation of a winding when a DC voltage is applied.

Insulation resistance testing is used to monitor the cleanliness and dryness of a stator winding. Insulation degradation as caused by thermal, mechanical or chemical processes, can sometimes be detected with insulation resistance testing. This is especially true if moisture or contamination is present on the stator winding.

Regular insulation resistance testing is recommended as a part of a preventive maintenance program. The insulation resistance test results should be corrected to a constant ambient (typically

40° C.) and then trended over time to help determine when stator maintenance is required. The cause of any sharp decrease or extended decline in insulation resistance should be determined and corrected.

NOTE: Perform an insulation resistance test before the initial application of voltage to the winding. This includes energizing for normal operation or for test purposes such as checking rotation. The insulation resistance must meet the minimum specified below.



CAUTION: Use care when measuring insulation resistance. Contact with high-voltage electrical current may be fatal. Disconnect motor from supply voltage before testing. Ground the winding after test to drain off all of the electrical charge.

NOTE: IEEE 43-2000 is highly recommended for insulation resistance testing and interpretation. The test levels and insulation resistance minimum specified below comply with IEEE 43-2000.

Measurement of Insulation Resistance

The insulation resistance should be measured with a motor-driven Megger type test set when possible. If one is not available, a hand-driven Megger or a voltmeter and microammeter with a DC power source may be used.

The test voltage is applied between the entire winding (all winding leads connected together) and ground. If the neutral leads of the winding are available, testing on individual phases may be done, with the remaining phases grounded. In this manner, the phase insulation is tested as well as the ground insulation.

The insulation resistance reading is typically taken after 1 minute of applied voltage unless a Polarization Index test is being done.

The winding insulation resistance should be measured:

- Before the initial operation of the motor.
- Before the windings are subjected to an over-voltage test.
- After the windings have been cleaned.
- After significant service or repair.

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- Before operation after an extended outage.
 - Before operation after being exposed to moisture.
 - As part of normal preventive maintenance.
 - Anytime there is reason to suspect that the insulation has been compromised.

Recommended Insulation Resistance Test Voltage

Rated Voltage (AC)	Test Voltage (volts, DC)
< 1000	500
1,000 to 2500	1000
2501 to 5000	2500
5001 to 12,000	5000
> 12,000	10,000

The resistance after one minute must be at least 100-megaohms when corrected to a 40°C ambient before over-voltage testing or energizing the winding.

A 500-volt test is the minimum recommended test voltage. Test voltages lower than the recommended levels in the table may be used. Historically, testing at 50% (or even less) of the recommend levels has been common.

Low Insulation Resistance

Moisture is the most likely cause of low insulation resistance readings, especially for new windings. Drying the winding with the proper application of heat will normally increase insulation resistance to acceptable levels.

The winding can be heated as follows to eliminate moisture:

Direct current (as from a DC welder set) can be passed through the winding. The total current should not exceed approximately 50% of the rated full load current. For windings with three leads, two leads are connected together to form one circuit through the winding. For windings with the neutral leads taken out, the phases should be connected into one series circuit.

Heated air from an outside source can be used to heat the winding. An electrical heat source is preferred over fuel burner source.

During moisture removal, ventilation must be provided to allow the moist air to escape the winding. Without ventilating the moist air, the dry out process can be extended indefinitely.

WARNING: It is essential that the heat be brought up gradually at first to allow the water vapor to find its way out naturally through the insulation. Rapid heating is likely to develop such steam pressure in local areas that escape passages are forced through the insulation, injuring it permanently. It is generally desirable to consume 15 to 20 hours in bringing the temperature up to the value required.

Insulation resistance readings may be taken during the dry out process. If taken, these readings will typically decrease as the winding is heated and then stabilize or increase after moisture is removed. Space heaters, if supplied on the winding, may be used in conjunction with other heat sources. As space heaters are sized to supply only enough heat to prevent condensation on windings, using them as the exclusive heat source would prolong the dry out process. If moisture contamination is suspected on a winding with space heaters, proper space heater operation should be verified.

Should the insulation resistance of the motor be less than that recommended, proceed as follows (measuring the insulation resistance after each step):

- Visually inspect windings and clean them if necessary.
- Separate the phases, if possible, so that their respective values of insulation resistance may be compared. This step is especially important if an abnormally low value of insulation resistance is obtained for the entire winding.

NOTE: The insulation resistance of one phase of a three-phase motor with the other two phases grounded, is roughly double that of the entire winding.

- If the values of insulation resistance obtained for the individual phases are of approximately the same magnitude and if the surfaces are relatively clean, make sure the winding is dry.
- If the steps described above do not remedy the low value of insulation resistance, the trouble may be due to the ground wall (the portion of the insulation, which is in contact with the motor core or frame). Should the trouble be confined to the ground wall insulation, call the local TECO-Westinghouse Field Service Engineers for assistance.

6.7 Polarization Index

The Polarization Index (PI) is the ratio of the insulation resistance reading at 10 minutes to the reading at 1 minute. The Polarization Index is not effected by temperature and can be used along with the level of insulation resistance to appraise the degree of winding contamination.

Typically, a PI of 2.0 is the recommended minimum. However, when the insulation resistance is of a sufficiently high level, the PI is meaningless. IEEE 43 does not recommend the PI as an assessment tool when the insulation resistance is above 5000-megaohms.

7.0 Bearings and Lubrication

7.1 Bearing Introduction

This part is intended to convey the proper understanding of the construction and operation of the bearings and lubrication systems used. It also provides the information necessary for the repair or replacement of bearings and specifies the type and method of lubrication to be used.

The sleeve bearing is split horizontally so that the bearing can be easily dismantled. The two halves are held in perfect alignment by dowels that are located in the mating surfaces. The two bearing housings are shimmed at the factory to maintain the relationship between the magnetic and mechanical centers. The number and the thickness of the shims at each end of the motor should be recorded before removing the bearing housings to ensure magnetic center integrity upon re-assembly of the equipment.

The bearing liner at the end opposite the shaft extension is insulated on the outer diameter of the shell to prevent the flow of shaft currents that might produce pitting damage to the babbitt and to the bearing journal. During routine maintenance outages, carefully inspect this insulation coating for signs of damage.

NOTE: A bearing insulation resistance test could confirm if damage exists. The drive end bearing must be isolated to perform this inspection. A common method is to raise the shaft and remove the lower half of the bearing liner. Notify the TWMC Field Service Department if damage is noted or suspected for suggestions for corrective action.

The temperature sensor supplied with this motor has an insulation isolator embedded. No further insulation is necessary if the original device or an exact duplicate is used in the re-assembly. A substitute, without this insulating sleeve, must be insulated. This is most easily accomplished with shrink tubing over the sensing end.

Notify the TWMC Field Service Department if damage is noted or suspected for corrective action.

Sleeve bearings have a babbitt lined surface on both end faces of the shell, in addition to the lining in the bore. The babbitted end faces are intended to only provide a bumping surface while the rotor, upon start-up, seeks its magnetic center. This surface cannot carry any significant continuous thrust load. In applications where this is the case, contact the TWMC Field Service Department for assistance.

7.2 Lubrication

Refer to the outline drawing for recommendations on the type and viscosity of the lubricating oil as well as suggested alarm and shut down temperatures. It should be noted here, that these are only suggestions and the user should decide the values to be used at his facility based upon his own experiences and the significance of the application

Bearing Maintenance

A bearing inspection should be made for the following conditions:

- During preventive maintenance outages
- If excessive bearing temperature or rapid changes in temperature are noted
- Unusual operating noises originating at the bearings
- Unusual changes in the color of the lubricant

The oil reservoirs of self (not flood) lubricated bearings should be drained and refilled about every six (6) months. More frequent changes may be needed on high speed (3600 rpm) motors or if severe oil discoloration or contamination occurs. In conditions where contamination does occur, it may be advisable to flush the reservoir with kerosene to remove any sediment before new oil is added. Proper care must be taken to thoroughly drain the reservoir of the flushing material before refilling with the new oil. Refill the reservoir to the center of the oil sight glass with a rust and oxidation inhibited, turbine grade oil. Refer to the outline for the correct viscosity. When flood lubricated bearings are supplied, the oil should be changed at intervals of 20,000 operating hours or every 2 years.

For specific information regarding the type of lubrication refer to the nameplate located on the non-drive end of the motor

7.3 Disassembly

- Remove the end-cover above the bearing housing cap and all auxiliary equipment that is attached at both ends of the motor.
- Remove the screws at the split line between the cap and the housing.
- Make sure that the lifting eyes are tight before using them to remove the bearing cap.
- Remove the top half of the bearing shell.
- Open both split lines of the oil ring by removing the screws. Separate both halves carefully without using pry tools or other devices as these may bend or twist the ring, which will impede its oil delivery ability. Reassemble the oil ring and visually check the geometry for roundness and flatness.

CAUTION: The floating labyrinth seals are fastened using a hook spring. During the dismantling operation tightly hold the hook spring, which is under tension, to prevent spring back. Failure to follow this instruction may lead to injury to the maintenance personnel.

- Carefully open the hook spring and remove both halves of the floating seal.
- The shaft must be raised enough to remove the weight of the shaft from the bottom half of the bearing shell. Secure the shaft in this position to prevent unintended motion. The lower half of the sleeve bearing shell may now be rolled out from under the shaft and removed.
- Clean the following parts with a non-aggressive detergent and inspect them for damage and replace any worn or broken parts
 - Top and bottom half of the housing
 - Top and bottom half of the bearing shell
 - Oil ring
 - All seals and sealing surfaces

The insulating coating that is bonded to the spherical housing seat.

CAUTION: If damage to the insulation is noted, contact the TECO-Westinghouse Motor Company Field Service Department for assistance. Do not return a motor that has suffered damage to this insulating coating to

service. Serious damage to the shaft journal and/or bearing babbitted surface may result.

7.4 Reassembly

CAUTION: Before making any re-assembly of the bearing, ensure that the housing and bearing parts are clean and in good condition free from damage and contaminants.

CAUTION: Before installing the lower half of the bearing, the shaft must be raised to at least the stator bore center to provide assembly space for the bearing shell.

CAUTION: Be careful to position the bearing and the shaft so that the side thrust surfaces of the shell are not damaged during the installation process.

NOTE: Use a liquid screw locking compound, (e.g. LOCTITE 242) on all fasteners.

Apply a small amount of the lubricant prescribed for this bearing on the spherical seat in the bottom half of the bearing housing and on the shaft journal. Place the bottom half of the bearing shell on top of the shaft and carefully roll it down and under the shaft journal. The split lines of both the housing and the bearing shell must be in perfect alignment.

Release the shaft and allow it to come to rest in the bore of the bearing. With the bottom half of the bearing in place, the floating labyrinth seals can be installed.

Assemble the two halves of the labyrinth seal. The bottom half of the seal, which fits into the groove in the housing, has drilled holes to permit escaping oil to drain back into the oil sump. These holes must be positioned to drain towards the bearing centerline. The top half has an anti-rotation stop. Apply a small amount of Curil-T to the sides and faces of the guide groove in the housing and to the sides and faces of the spring groove of the seal. Put the bottom half of the seal onto the top of the shaft and roll it into position under the shaft. Place the top half of the seal onto the shaft and align both halves of the seal to each other.

CAUTION: The anti-rotation stop can be damaged if the top half of the seal is assembled in the wrong direction. Installation of the bearing cap will crush it if the top half is reversed.

CAUTION: During the assembly of the hook spring that secures the two halves of the labyrinth seal, hold the ends securely to prevent injury if they should spring back.

Push the hook spring into the space between the seal groove and the housing until both ends project out from the split line. Pull the hook spring around the seal and engage both ends.

Turn the labyrinth seal on the shaft to verify that it has been assembled properly and recheck the position of the anti-rotation stop and the oil return grooves.

Reassemble the oil ring. Open the split lines by removing the screws and carefully separating the two halves. Do not use force or pry the two halves apart for permanent damage to the ring may result. Place both halves of the oil ring into the bearing shell groove encircling the shaft. Press the positioning pins into place in both halves. Adjust both halves of the oil ring until the split lines are aligned and then tighten the screws.

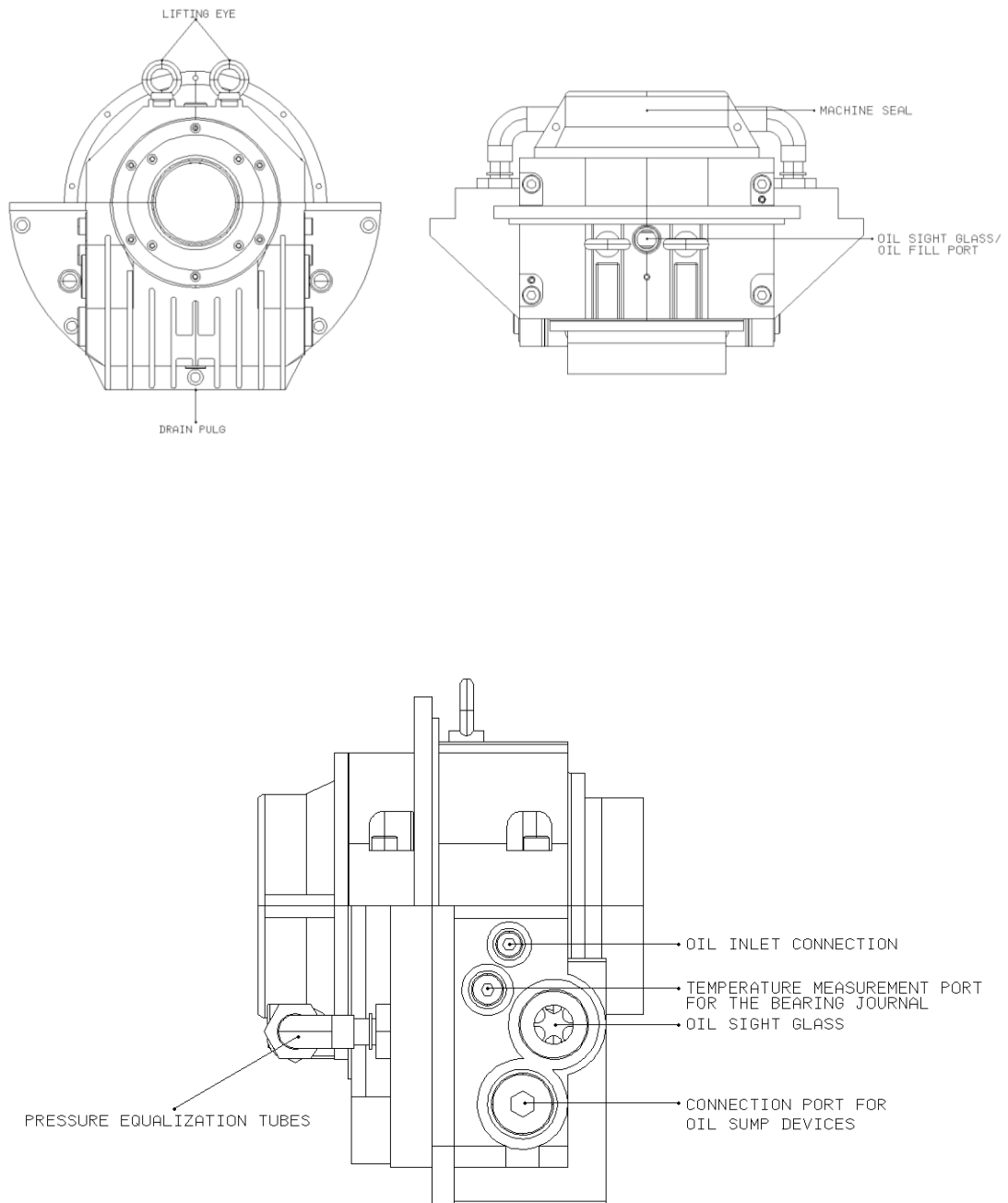
The top half of the bearing shell can now be installed. Apply a generous amount of the prescribed lubricant to the shaft. Both halves of the bearing shell have an engraved number embossed on them. Verify that these are aligned and on the same side. Failure to position both halves of the bearing correctly could result in bearing or shaft damage.

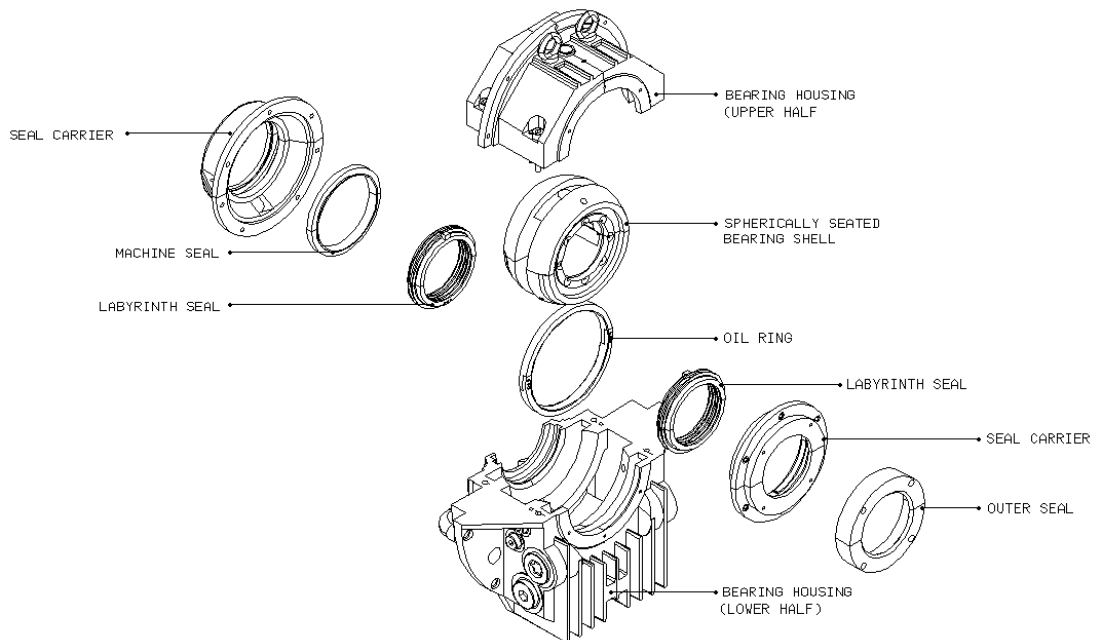
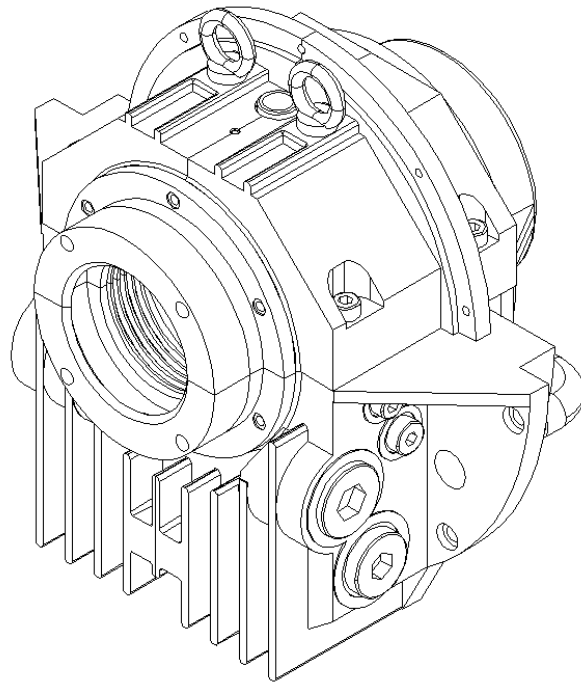
Before closing the bearing check the mobility of the floating seals and of the loose oil ring. Binding or sluggish motion should be corrected before proceeding.

NOTE: An anti-rotation pin in the bearing cap and a corresponding hole in the top half of the bearing shell has been provided. Verify that the orientation of these is correct. Verify that the engraved numbers on both halves of the bearing housing correspond. Clean the split lines surfaces of the top and bottom halves of the housing. Apply a generous amount of Curil-T to the

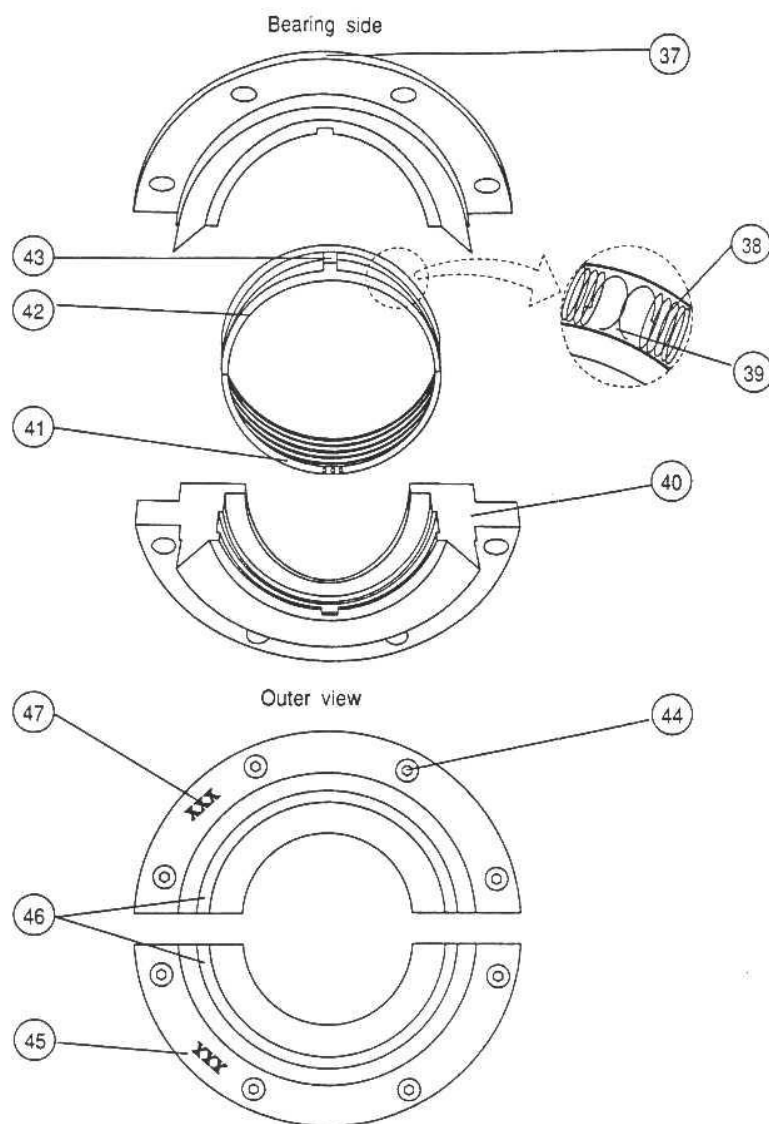
bottom half of the housing. Lower the cap into place. Gently hit the bottom half of the housing a few times with a rawhide or nylon hammer to ensure proper alignment of the bearing shell and the shaft journal. Install and torque the split bolts.

Reassemble the end-cover above the bearing cap to enclose the motor and reassemble all auxiliary equipment that was removed for maintenance.





-
- 37 Seal carrier - top half
 - 38 Hook spring
 - 39 Groove
 - 40 Seal carrier - bottom half
 - 41 Bottom half of the seal
 - 42 Top half of the seal
 - 43 Anti - rotation pin
 - 44 Screw
 - 45 Engraved number
 - 46 Groove (Type 11)
 - 47 Engraved number



8.0 Accessories

8.1 List of Accessories

The following equipment has been provided with this motor. Refer to the Outline drawing for specific information, schematic diagrams, and recommended alarm and trip values.

Space Heaters

Space Heaters to prevent moisture from accumulating on the stator winding. When the motor is shut down for servicing, power to the heaters should be disconnected before personnel are permitted to approach the areas near the heater wiring. During normal shutdowns the power for the heaters should be applied manually or by automatic control. Refer to the Storage Section regarding the use of the space heaters when the motor is not in operation.

Space Heater Replacement

CAUTION: Before replacing burned out space heaters, turn off all power to the motor by opening the appropriate switches and circuit breakers. Lockout these controls to prevent their being closed by mistake.

The space heaters may be replaced as follows:

- Remove both side covers from the frame. The space heater draw out tray can be unfastened and pulled out to give accessibility to the heaters. The location of the access to the space heaters is shown on the outline drawing, Figure 1.
- Disconnect the leads from the heater terminals.
- Remove the bolts that hold the heaters in place.
- Place the new heater in the same location as the burned out unit and replace the bolts on end of the heater, (replacements must be exactly the same as the original equipment; consult the TECO-Westinghouse factory for the heater part number).
- Replace the leads on the heater terminals.
- Check heater resistance prior to energizing the heaters. Expected resistance value is 14.4 ohms.

-
- When the motor is shut down for servicing, power to the heaters should be disconnected before personnel are permitted to approach the areas near the heater wiring. During normal shutdowns heater power is applied manually or by automatic control from the switchgear. Refer to Part 2 regarding use of space heaters when the motor is in storage.

Temperature Detectors

Stator Temperature Detectors for monitoring the temperature of the stator winding.

Detectors for monitoring the temperature of the bearings.

A Dial Thermometer for local visual indication of the bearing temperature.

8.2 Renewal Parts

Renewal parts information may be obtained from the nearest TECO-Westinghouse Sales Office. Be sure to name the part or parts required and give the complete nameplate reading on the motor for positive identification.

9.0 Troubleshooting

The following is a summary of the more commonly encountered problems, their probable causes, and what to look for.

Trouble	Cause	Investigate
Motor will not start or fails to reach full speed	Improper connections	Check motor and control connections.
	Improper line voltage	Check line voltage at motor terminals-see motor nameplate for voltage requirements.
	Protective devices tripped	Check overload relay or fuses.
	Stator winding failure	Check for open circuit, short circuit or grounded winding.
	Excessive load	Check motor rotor and load for locked or frozen condition. See starting duty nameplate for max. load inertia.
Hot bearing	Incorrect lubricant Improper lubricant level	See lubrication nameplate or outline drawing for recommended oil and proper oil level.
	Contaminated oil	Drain and refill. Check for dirt in bearings and sump.
	Oil ring stuck	Check ring for roughness and guides for alignment.
	Oil ring not immersed in oil	Check for improper oil level or ring size.

Trouble	Cause	Investigate
Hot bearing (continued)	Excessive load	Check alignment. Look for axial thrust loading. Check for bent shaft.
	Rough bearing surfaces	Check for displaced babbit, pitting due to bearing currents, corrosion. Check bearing insulation if bearing surface is pitted. Polish journal and bearing bore, if required.
Oil leaks	Housing split surfaces not sealed	Remove cap and check parting surfaces. Re-seal.
	Improper oil drainage	Check drain lines for obstructions, proper slope.
Vibration, noise Note: Always check vibration frequency and its relation to rotational speed N. 1XN = Rotational speed vibration frequency 2XN = Twice rotational speed vibration frequency. (Example: 3600 RPM motor; vibration frequency rotational speed. $N = \frac{3600}{60} = 60 \text{ Hz.}$ 60 sec/min)	Rotor unbalance	1XN frequency. Re-check with motor uncoupled from load.
	Loose mounting or poor foundation	1XN frequency: Re-tighten bolts, check shims, stiffen mounting.
	Parts rubbing shaft	1XN - Phase angle varies with time.
	Broken rotor bar	1XN - Amplitude is modulated with time. Most likely to occur under load.

Trouble	Cause	Investigate
Vibration, noise (continued)	Coupling unbalance	1XN - Check to see if excess key is trimmed off - see Cross Section Drawing - Description Section.
	Worn coupling	1XN, sometimes 2XN.
	Misalignment	1XN, usually high axial amplitude, sometimes 2XN.
	Motor support structural resonance	1XN, large amplitude at motor feet - disappears quickly with speed change or when motor de-energized.
	Out of round journal	Multiples of rotational speed.
Low insulation resistance	Moisture, dirt, metallic particles or other contaminants	Motor cleanliness. Clean and dry out as required.
	Mechanical damage	Check coil bracing and wedging. Check for foreign objects or excessive vibration.
Temperature Detector alarm or trip	Excessive temperature	Check for overloads, ventilation restrictions, excessive dirt build up, unbalanced voltages, and improper voltage.

10.0 Bolt Torque Specifications

GRADE IDENTIFICATION MARKING--3 RADIAL LINES

(LOCATED ON BOLT HEAD)

GRADE 5 SAE THREAD SERIES

Size	Threads	Stress Area	Grade Designation	Hardness		Min. Strength PSI		Preload		Torque FT. LBS.	
				Min.	Max.	Yield	Tensile	PSI	LBS.	Dry	Lub.
1/4	20 UNC	.0318	5	25	34	92,000	120,000	63,750	2,027	8	6
1/4	28 UNF	.0364							2,321	10	7
5/16	18 UNC	.0524							3,341	17	13
5/16	24 UNF	.0580							3,698	19	14
3/8	16 UNC	.0775							4,941	31	23
3/8	24 UNF	.0878							5,578	35	26
7/16	14 UNC	.1063							6,777	49	37
7/16	20 UNF	.1187							7,567	55	41
1/2	13 UNC	.1419							9,046	75	56
1/2	20 UNF	.1599							10,194	85	64
9/16	12 UNC	.182							11,603	109	82
9/16	18 UNF	.203							12,941	121	91
5/8	11 UNC	.226							14,408	150	112
5/8	18 UNF	.256							16,320	170	127
3/4	10 UNC	.334							21,293	266	199
3/4	16 UNF	.373							23,729	297	223
7/8	9 UNC	.462							27,027	394	295
7/8	14 UNF	.509							29,777	434	325
1	8 UNC	.606							35,451	591	443
1	14 UNS	.679							38,786	646	484
1-1/8	7 UNC	.763		19	30	81,000	105,000	55,500	42,347	794	595
1-1/8	12 UNF	.856							47,508	891	668
1-1/4	7 UNC	.969							53,780	1,120	840
1-1/4	12 UNF	1.073							59,552	1,241	931
1-3/8	6 UNC	1.155							64,103	1,469	1,102
1-3/8	12 UNF	1.315							72,983	1,673	1,255
1-1/2	6 UNC	1.405							72,978	1,949	1,462
1-1/2	12 UNF	1.581							87,746	2,194	1,645

GRADE IDENTIFICATION MARKING-- 5 RADIAL LINES
(LOCATED ON BOLT HEAD)
GRADE 8 SAE THREAD SERIES

Size	Threads	Stress Area	Grade Designation	Hardness		Min. Strength PSI		Preload		Torque FT. LBS.	
				Min.	Max.	Yield	Tensile	PSI	LBS.	Dry	Lub.
1/4	20 UNC	.0318	8	32	38	130,000	150,000	90,000	2,862	12	9
1/4	28 UNF	.0364							3,276	14	10
5/16	18 UNC	.0524							4,716	25	19
5/16	24 UNF	.0580							5,220	27	20
3/8	16 UNC	.0775							6,975	43	32
3/8	24 UNF	.0878							10,683	49	37
7/16	14 UNC	.1063							9,567	70	52
7/16	20 UNF	.1187							10,683	78	58
1/2	13 UNC	.1419							12,771	107	80
1/2	20 UNF	.1599							14,391	120	90
9/16	12 UNC	.182							16,380	154	115
9/16	18 UNF	.203							18,270	171	128
5/8	11 UNC	.226							20,340	212	159
5/8	18 UNF	.256							23,040	240	180
3/4	10 UNC	.334							30,060	376	282
3/4	16 UNF	.373							33,570	420	315
7/8	9 UNC	.462							41,580	608	456
7/8	14 UNF	.509							45,810	669	502
1	8 UNC	.606							54,540	911	683
1	14 UNS	.679							59,670	996	747
1-1/8	7 UNC	.763							68,670	1,290	967
1-1/8	12 UNF	.856							77,040	1,448	1,086
1-1/4	7 UNC	.969							87,210	1,821	1,386
1-1/4	12 UNF	1.073							96,570	2,016	1,512
1-3/8	6 UNC	1.155							103,950	2,387	1,790
1-3/8	12 UNF	1.315							118,350	2,717	2,038
1-1/2	6 UNC	1.405							126,450	3,168	2,376
1-1/2	12 UNF	1.581							142,290	3,564	2,673

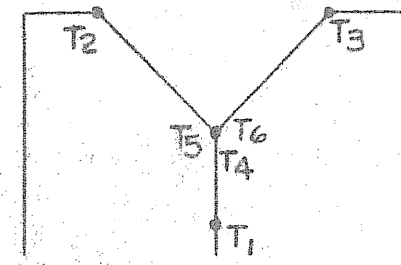
SAFETY MEASURES

MACHINES OF VARIOUS DESIGNS ARE APPLIED TO A VARIETY OF APPLICATIONS. IN THE INSTALLATION AND USE OF THIS MACHINE, IT IS THE USER'S RESPONSIBILITY TO:

COMPLY WITH ALL FEDERAL, STATE, AND LOCAL LAWS, INCLUDING OSHA.

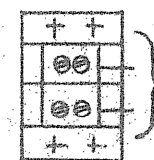
PROVIDE FOR ITS OPERATION AND MAINTENANCE BY TRAINED AND AUTHORIZED PERSONNEL ONLY.

PROTECT AGAINST PERSONNEL HAVING CONTACT WITH ROTATING AND ELECTRICAL PARTS WHICH MAY BE PRESENT AND HAZARDOUS AS A RESULT OF THE USER'S APPLICATION.



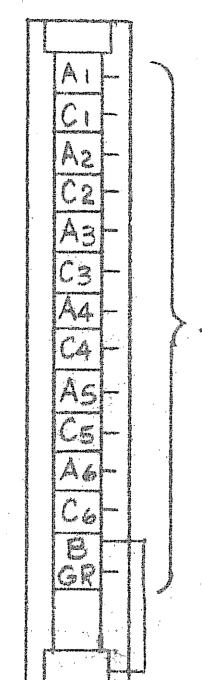
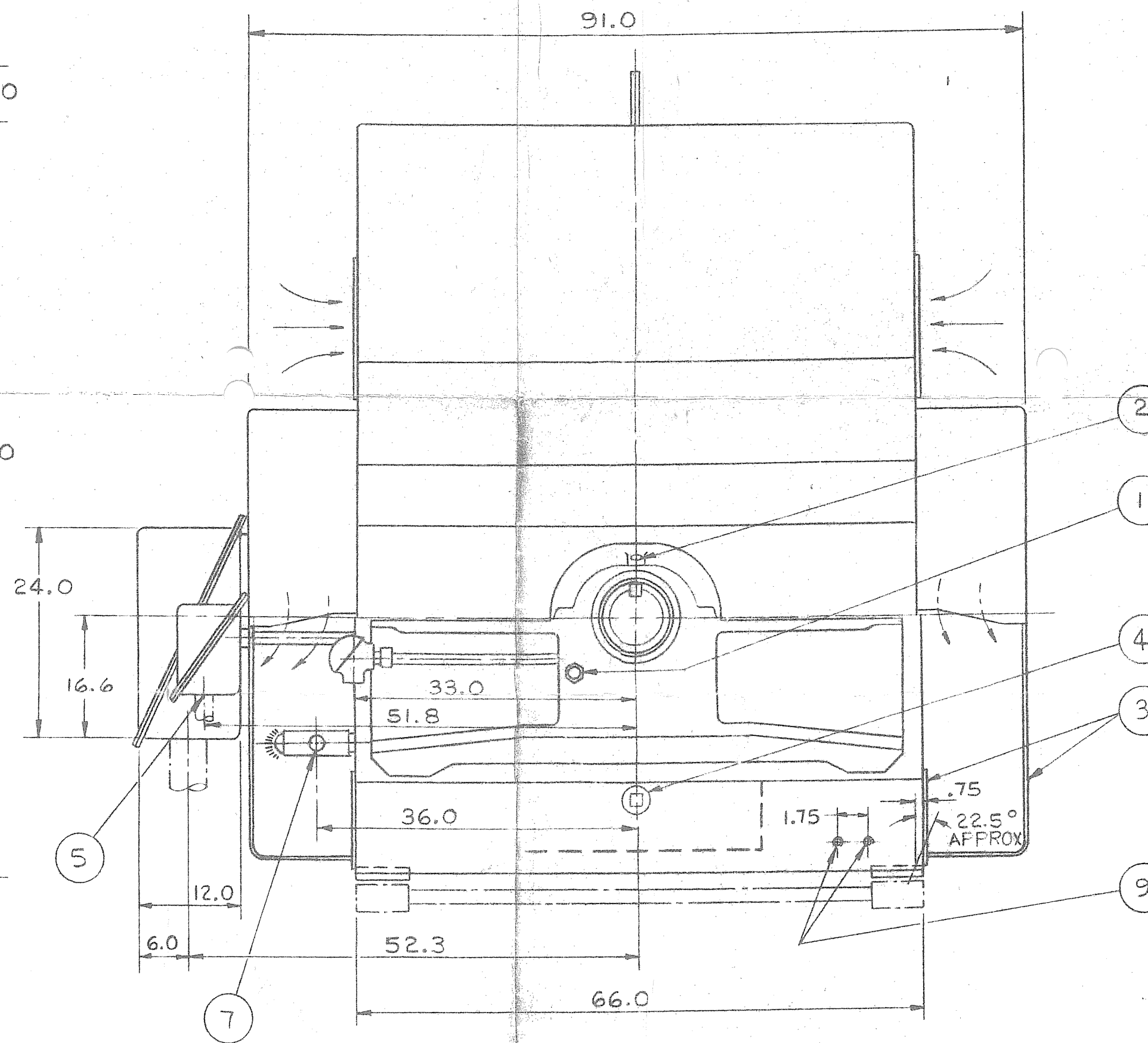
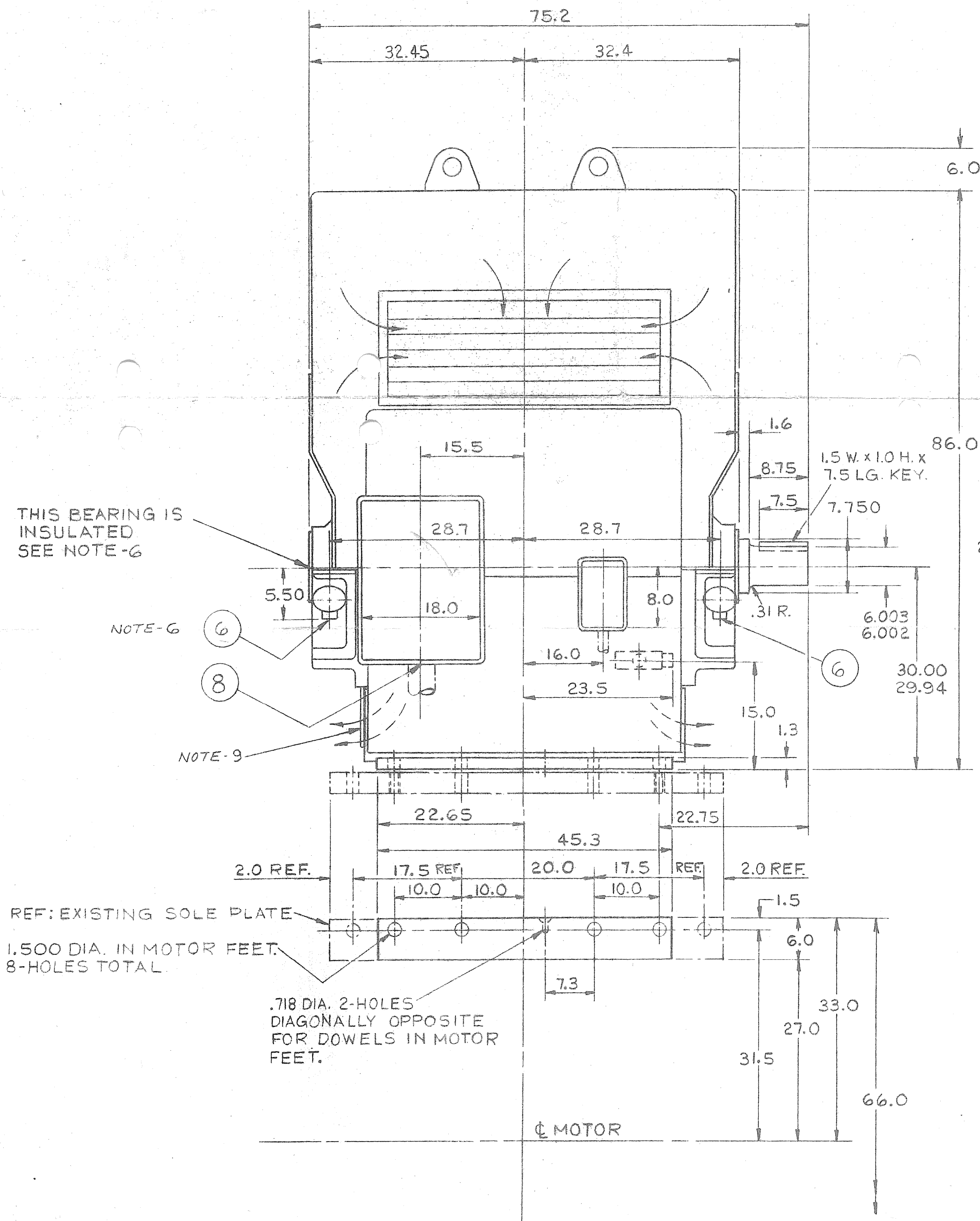
FOR 4000 VOLTS CONNECT WYE AS SHOWN

DETAIL "A"



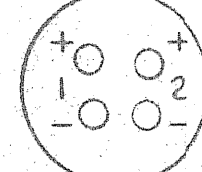
CUSTOMER'S CONNECTION TO SPACE HEATERS

DETAIL "B"



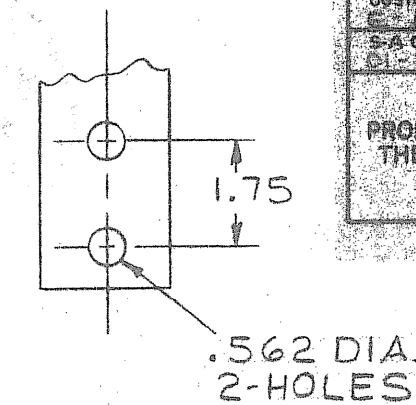
CUSTOMER'S CONNECTION TO STATOR R.T.D.'S.

DETAIL "C"



CUSTOMER'S CONNECTION TO BEARING T.C.'S

DETAIL "D"



DETAIL "E"

NOTES:

1. MOTOR GOOD FOR EITHER DIRECTION OF ROTATION.
2. USE A HIGH QUALITY PETROLEUM OIL HAVING RUST AND OXIDATION INHIBITORS AND A VISCOSITY OF 300 TO 350 SUS AT 100°F. AND A VISCOSITY INDEX OF 95 MINIMUM. BEARING OIL CAPACITY = 3.3 GALLONS PER BEARING.
3. OIL LEVEL - 6.5 INCHES BELOW HORIZONTAL CENTERLINE.
4. MAXIMUM DIAMETER OF LATHER CENTER = 1.12"
5. TOTAL SHAFT END FLOAT = .5 IN. LIMIT COUPLING END FLOAT TO .188 IN. TOTAL. ELASTIC AXIAL SELF-CENTERING COUPLINGS ARE SATISFACTORY WITHOUT THIS PRECAUTION. INFORMATION PLATE ON COUPLING END BEARING BRACKET GIVES THE END FLOAT EXTREMES. THE COUPLING MUST BE ASSEMBLED TO PREVENT ROTOR FROM TRAVELING TO EITHER EXTREME.
6. BEARING ON END OPPOSITE COUPLING IS INSULATED. CUSTOMER IS TO PROVIDE INSULATED CONNECTIONS TO BEARING THERMOCOUPLE.
7. CONDUIT BOX MAY BE ROTATED IN 90° INCREMENTS.
8. ALLOW 30.0 IN. ABOVE MOTOR FOR DISMANTLING.
9. ROTOR CAN BE REMOVED AXIALLY THRU END OPPOSITE COUPLING. COVER BELOW BEARING BRACKET MUST BE REMOVED.
10. FILTERS ARE REMOVABLE THRU AIR INTAKE.

LEGEND:

1. OIL SIGHT GAUGE EACH BEARING.
2. OIL RING SIGHT GLASS EACH BEARING.
3. REMOVABLE COVERS FOR ACCESS TO FOUNDATION BOLTS.
4. PIPE PLUG FOR AIR GAP INSPECTION.
5. STATOR R.T.D.'S - 6-10 OHM. BOX HAS HOLE FOR CUSTOMERS 1.5 IN. CONDUIT. SEE DETAIL "C". (A-10)
6. BEARING THERMOCOUPLES - "LEADS AND NORTHROP" COPPER CONSTANTAN DUAL ELEMENT. ONE EACH BEARING. THERMOCOUPLE HEAD HAS .75 N.P.T. FOR CUSTOMER CONNECTION. SEE NOTE #6 AND DETAIL "D" (A-8).
7. SPACE HEATERS - 1.5 K.W. 120 VOLT WITH INDICATING LIGHT. UNILET HAS 1.0 N.P.T. FOR CUSTOMERS CONNECTION. SEE DETAIL "B" (K-11).
8. MAIN LEAD TERMINAL BOX. BOX CONTAINS 3-STATOR LEADS, ONE TERMINAL PER LEAD WITH TONGUE DRILLED AS SHOWN IN DETAIL "E" (B-6). LUGS ARE BUNRDY TYPE "YA" 15.0 IN. OF MAIN AND NEUTRAL LEADS IN BOX. NEUTRAL LEADS ARE CONNECTED AND INSULATED. SEE DETAIL "A" (K-13) AND NOTE #7.
9. GROUNDING HOLES: 2-SETS OF 2 HOLES PER SET LOCATED DIAGONALLY OPPOSITE ON MOTOR FRAME. HOLES ARE .5-13 U.N.C. -2.

CUSTOMER	Phanto Rice Electric Power Authority
CUSTOMER ORDER NO.	6-14250
S-A ORDER NO.	01-0510-47709
PRODUCTION WILL PROCEED ON THE BASIS OF THIS DRAWING	

SIEMENS-ALLIS
CERTIFIED FOR CONSTRUCTION
CUSTOMER INITIATED
CHANGES MAY AFFECT PRICE AND DELIVERY
LINE IN U.S.A. - ACB-37

ESTIMATED WEIGHTS

STATOR	6500 #
ROTOR	6400 #
MISCELLANEOUS	7900 #
TOTAL	20,800 #

CONFIDENTIAL-PROPERTY OF SIEMENS-ALLIS, INC. 3005 MI. PLANT		NAME VersaPac MOTOR OUTLINE	
UNLESS OTHERWISE SPECIFIED:		MATERIAL 1750 H.P., 4000 V., 232 AMP 595 R.P.M., 3-PH., 60 HZ.	
1. PLACE DEC 2	ANGULAR	5148 NEMA II R.H. BOX SLV. BRGS.	
2. PLACE DEC 2	2	WT R	
3. PLACE DEC 2	2	F	
FOR TOLERANCES NOT SPECIFIED SEE 300-SERIES SHOP PRACTICE STANDARDS		THIRD ANGLE PROJECTION	
DR J.P.G. 10-9-80	SIMILAR TO 06-317-887-413	10/23/80	
CH AD 10-13-80	SCALE SHEET	PART NO.	
AP 09/10/13-80	NTS	05-417-644-403	

05-417-644-403

01

01-0510-47709

Government of Puerto Rico

Puerto Rico Electric Power Authority



Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES
Submittal to COR3 and FEMA



***Condensate Pump (CP) Motor,
Costa Sur Power Plant - units 5 & 6***

1/26/2022



Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes



Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	Costa Sur Power Plant, units 5 and 6 – CP Motor
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number (Formerly Project Worksheet)	136271 - MEPA078 PREPA Island Wide FAASt Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: <Name>

<Insert title here>

PREPA Project Sponsor: <Name >

<Insert title here>



Section 2. Facilities

2.1. Facilities List

Name		GPS Location
Costa Sur Power Plant	unit 5	██████████
	unit 6	██████████

Note: GPS coordinates are required for all facilities.

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

Costa Sur Power Plant needs to purchase a Condensate Pump (CP) Motor as spare part, in the event that one of the motors being used is damaged. As a key component of the Rankine thermodynamic process, the CP delivers water from the unit's condenser to the suction header of the Deaerator pumps. By doing this operation, an adequate water level is maintained in the condenser for a continuous operation of the cycle. Two pumps are required for full load. The loss of one of them will reduce the capacity by 100 MW and since there is not a spare motor for this pump, it is cost effective to purchase a spare motor considering the extensive downtime period to refurbish a damaged motor (over three months).

Section 3. Scope of Work



3.1. Scope of Work Description

The scope of work for the Condensate Pump Motor for Costa Sur Power Plant units 5 and 6 will consist of the following:

- Acquisition of one (1) Condensate Pump Motor (500hp) to be storage as spare part to avoid units forced outages and/or load limitations.

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards:** Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project:** Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
 - a. Other improvements, not required by codes and standards
 - b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate)

If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.

Restores to Codes/Standards

Note: If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.

3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?



4.1. Codes, Specifications, and Standards

Yes/No. If yes, describe how incorporated below.
<ul style="list-style-type: none"> • (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE) • (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE) • Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730-B2 - U.S. Department of Agriculture Rural Electric Service (RUS) • International Building Code (IBC) - International Code Council (ICC) • International Energy Conservation Code (IECC) - International Code Council (ICC) • International Existing Building Code (IEBC) - International Code Council (ICC) • National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers • National Electrical Code (NEC) - National Fire Protection Association (NFPA) • FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.
<ul style="list-style-type: none"> • 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA) • 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA) • ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE) • International Building Code (IBC) - International Code Council (ICC) • Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA) • Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA) • RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS) • Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.

Cost Type	Amount (\$)
Acquisition and delivery	\$870,000.00
Total Project Estimated Cost	\$870,000.00



Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: If available, detailed engineering cost estimates will be included as an attachment.

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

Program Manager's Printed Name

Date

Title

Signature

Section 9. PREPA Project Sponsor Comments

Comments
<Insert any comments here>

PREPA Project Sponsor's Printed Name

Date

Title

Signature



Section 10. Attachments

10.1. Project Detailed Cost Estimates

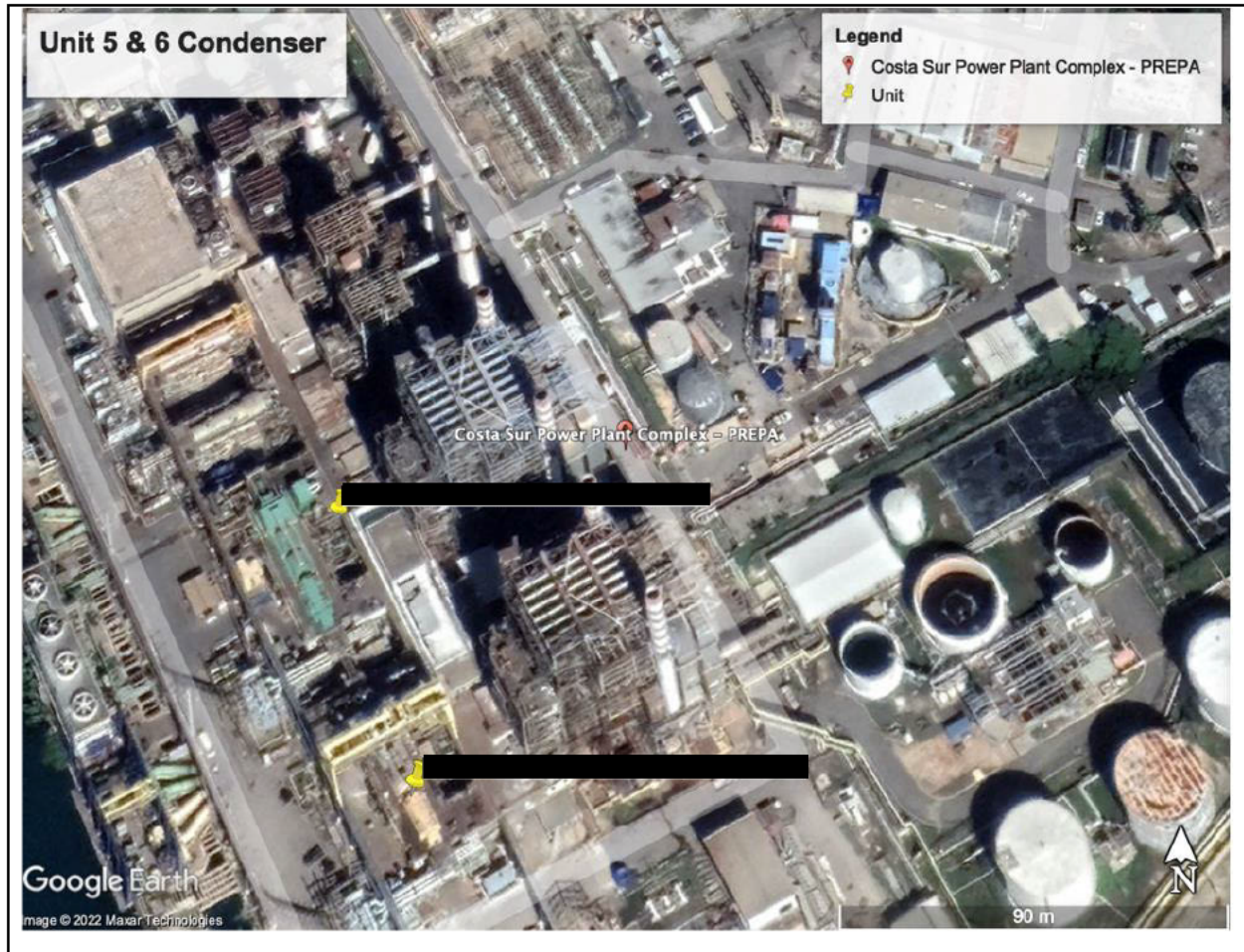
Please see attached the following:

- Scope of Work

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures



10.4. Other: (Please Describe)

N/A



GOVERNMENT OF PUERTO RICO
PUERTO RICO ELECTRIC POWER AUTHORITY

Project number: 54

Project name: Procurement of Condensate Pump (CP) spare motor for units 5 & 6

Estimated cost: \$870,000

Material Request:

Scope of work

As a key component of the Rankine thermodynamic process, the Condensate pump delivers water from the unit's condenser to the suction header of the Deaerator pumps. By doing this operation, an adequate water level is maintained in the condenser for a continuous operation of the cycle. Two pumps are required for full load. The loss of one of them will reduce the capacity by 100 MW and since there is not a spare motor for this pump it is cost effective to purchase a spare motor considering the extensive downtime period to refurbish a damaged motor (over three months). Thus, the scope of this project is to purchase a spare motor (500hp) for this pump for units 5 & 6.



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AC MACHINES

Customer Baldwin Lima Hamilton Puerto Water

Customer's Order No. 550-50373-00-040-1 District Office Requisition No. 40533-1-2 A-C Order Number 93-0500-40532
40534-1-2 2-0512-40533
40535-1-2 2-0512-40534
40917-1-2 2-0512-40535
2-0512-40917

Machine Type ANVZ Serial Number(s) 40533-1-2 A-C Mfg. No. 2-0512-40533
40534-1-2 2-0512-40534
40535-1-2 2-0512-40535
40917-1-2 2-0512-40917

Rating: Hp 500; Kw -; Rpm 888; Volts 4000;

Phase 3; Cycles 60; P.F. -%; Amps 66.2; Service Factor 1.15;

Insulation: Stator - Class B Rotor - Class Cage

Maximum Ambient Air Temperature 40 °C

Temperature Rise: Continuous 100 % Load: Stator 55 °C by THER. ☒ DET. ☐

Rotor NO INJURY

- % Load: Stator - °C by THER. ☐ DET. ☐

Rotor - °C by RES. -

Resistance at 25 °C: Stator .664 Ohms Terminal to Terminal

Rotor - Ohms -

Bearings: Lubrication System: 1 - Oil Rings ☐ 2 - Recirculating System ☐ 3 - Special ☐
4 - Recirculating System with Oil Rings ☐ 5 - Grease ☐

Lubricant: Sleeve and Kingsbury type thrust Bearings - Use a good grade of industrial oil having a viscosity of - to - S.S.U. at 100° F.

Lower Bearing Anti-Friction Bearings (Grease-Lubricated): Use a good grade of anti-friction bearing type grease of soda base, having a high melting point, and free of solid fillers or other harmful ingredients. The consistency of the grease should be NLGI grade #2 or #3.

Upper Bearing Anti-Friction Bearings (Oil-Lubricated): The spherical roller thrust bearing should use a good grade of industrial oil having a viscosity of 600 SSU at 100° F.

Locked Rotor Starting Current 640 % of Full Load Current. Air Gap In Inches .060

Wound Rotor Motor - Secondary Characteristics: (a) Open Circuit Secondary Voltage E_2 - Volts.

(b) Full Load Secondary Current I_2 - Amps.

Recommended Starting Restrictions: Frequent starting may damage the motor windings. With motor cold, do not attempt more than 3 consecutive starts, and allow the motor to coast to rest between starts. With motor hot, do not attempt more than 2 consecutive starts. An interval of 20 minutes, with motor running, or 40 minutes, with motor not running, must elapse before an additional start.

EQUIPMENT SPECIFICATIONS

CONDENSATE PUMPS

S.O. 550-50373

SOUTH COAST STATION UNITS 5 AND 6

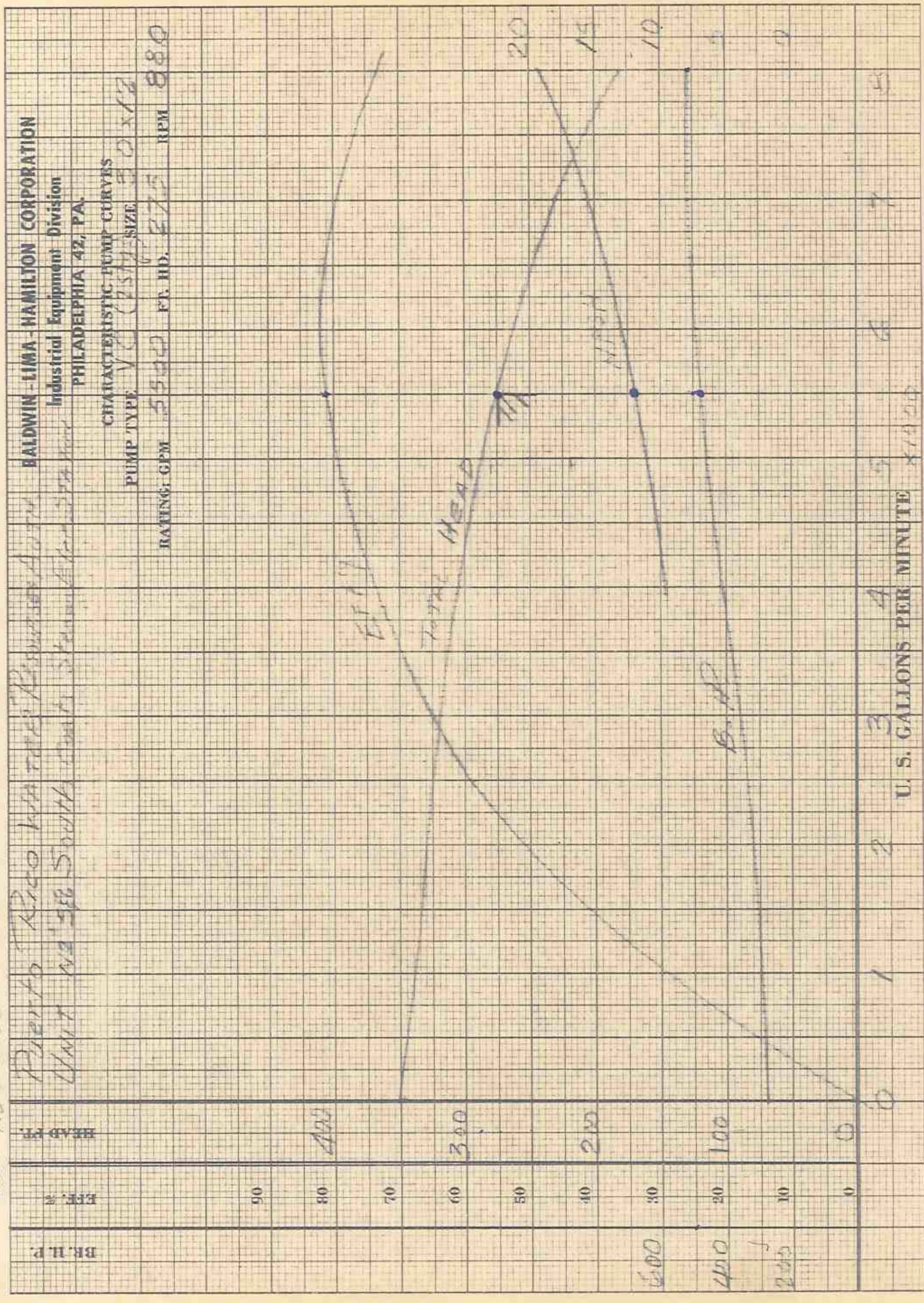
Quantity	- Two For Each - Unite #5 and #6
Type	- "VC" Two Stage, Vertical
Size	- 30 x 12
Capacity	- 5500GPM
Total Dynamic Head	- 290 Ft.
Speed	- 888 RPM
Motor	- Allis-Chalmers 500 H.P., 888 R.P.M. No-Load Speed, Vertical, Solid Shaft Induction Motors for Operation on 4000 Volts, 3 Phase, 60 cycle Power. Furnished by Baldwin-Lima-Hamilton Corp.

LIST OF ILLUSTRATIONS

<u>CONDENSATE PUMPS</u>	<u>DRAWING NUMBER</u>
Outline Dimensions.....	550-4-00244-2
Assembly Section.....	550-6-00032
Performance Curve.....	CV-7081-1
Speed Torque Curve.....	CV-7082-1

CURVE NO. CV-7081-1

REF. 1.5" x 10"



CURVE NO. CV-7081-1

Puerto Rico Water Resources Auth.

BALDWIN - LIMA - HAMILTON CORPORATION

Industrial Equipment Division

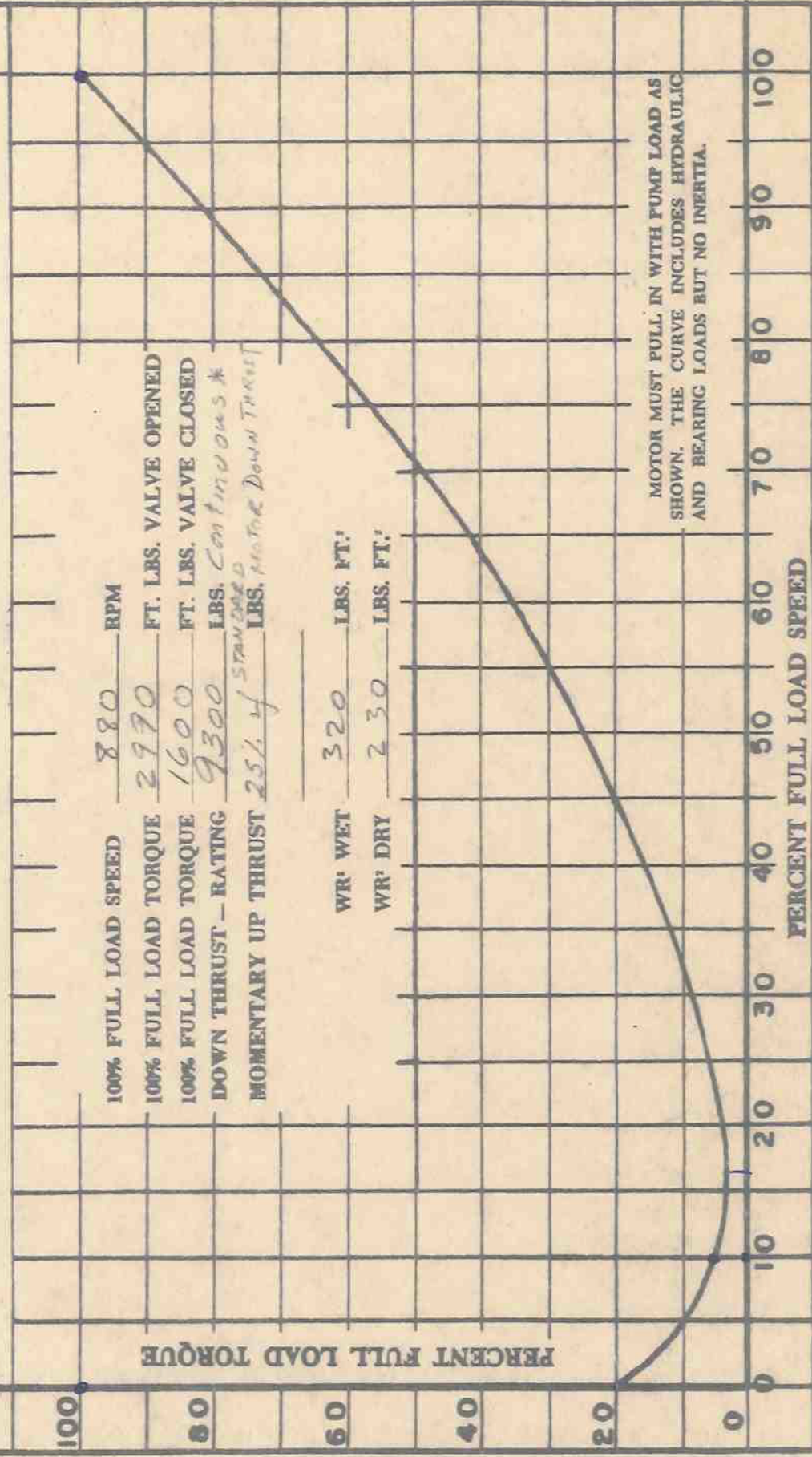
PHILADELPHIA 42, PA.

UNIT # 546 South Coast Steam

SPEED TORQUE CURVES

PUMP TYPE VC (254) SIZE 30x12

RATING: GPM 5500 FT. HD. 275 RPM 880



* 3 years minimum life AF3MA.

Government of Puerto Rico

Puerto Rico Electric Power Authority



Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES
Submittal to COR3 and FEMA



***4160V Electric Cable,
Costa Sur Power Plant – Unit 5***

1/27/2022



Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes



Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	Costa Sur Power Plant, unit 5 – 4160V Electric Cable
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number (Formerly Project Worksheet)	136271 - MEPA078 PREPA Island Wide FAASt Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: <Name>

<Insert title here>

PREPA Project Sponsor: <Name >

<Insert title here>



Section 2. Facilities

2.1. Facilities List

Name	GPS Location
Costa Sur Power Plant, unit 5 cable start cable end	<div></div> <div></div> <div></div> <div></div>

Note: GPS coordinates are required for all facilities.

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

Costa Sur Power Plant wants to acquire 6000 ft. of special construction electrical cable, to replace the cables of the Normal Service Station Transformers (NSST) 5A and 5B of unit 5. The NSST provide electrical power to all the auxiliary equipment of the generating unit. These step-down transformers supply 4160v to the switchgears by using three (3) underground cables for a total of nine (9) cables (1500Kcmil Insulation XLPE 5kv). The cables haven't been change since their original installation in the 1970ths so the expected useful life is overdue. In addition, the cables are full of residual oil from the transformers, which deteriorates the insulation of the cables. An electrical failure could cause a catastrophic fire, so the replacement will bring reliability to the unit for a long term period. In 2017 the cables of NSST 6B were changed after a failure of two of them, and in 2020 the ones of the NSST 6A were replaced too. In both NSSTs, the cable's insulation was in bad condition.



Section 3. Scope of Work

3.1. Scope of Work Description

The scope of work for the 4160V Electrical Cable for Costa Sur Power Plant unit 5 will consist of the following:

- Acquisition, delivery and installation of 6000 ft. of special construction electrical cable (1500Kcmil Insulation XLPE 5kv).
- The delivery time is about 4 months for the cables, and the installation time is 6 weeks.

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards:** Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project:** Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
 - a. Other improvements, not required by codes and standards
 - b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate)

If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.

Restores to Codes/Standards

Note: If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.

3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?



4.1. Codes, Specifications, and Standards

Yes/No. If yes, describe how incorporated below.
<ul style="list-style-type: none"> • (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE) • (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE) • Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730B-2 - U.S. Department of Agriculture Rural Electric Service (RUS) • International Building Code (IBC) - International Code Council (ICC) • International Energy Conservation Code (IECC) - International Code Council (ICC) • International Existing Building Code (IEBC) - International Code Council (ICC) • National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers • National Electrical Code (NEC) - National Fire Protection Association (NFPA) • FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.
<ul style="list-style-type: none"> • 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA) • 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA) • ASCE 7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE) • International Building Code (IBC) - International Code Council (ICC) • Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA) • Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA) • RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS) • Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.

Cost Type	Amount (\$)
Acquisition and delivery	\$275,000.00
Installation (Labor)	\$100,000.00
Total Project Estimated Cost	\$375,000.00

Section 6. 406 Hazard Mitigation Proposal



6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: *If available, detailed engineering cost estimates will be included as an attachment.*

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

Program Manager's Printed Name

Date

Title

Signature

Section 9. PREPA Project Sponsor Comments

Comments
<Insert any comments here>

PREPA Project Sponsor's Printed Name

Date

Title

Signature



Section 10. Attachments

10.1. Project Detailed Cost Estimates

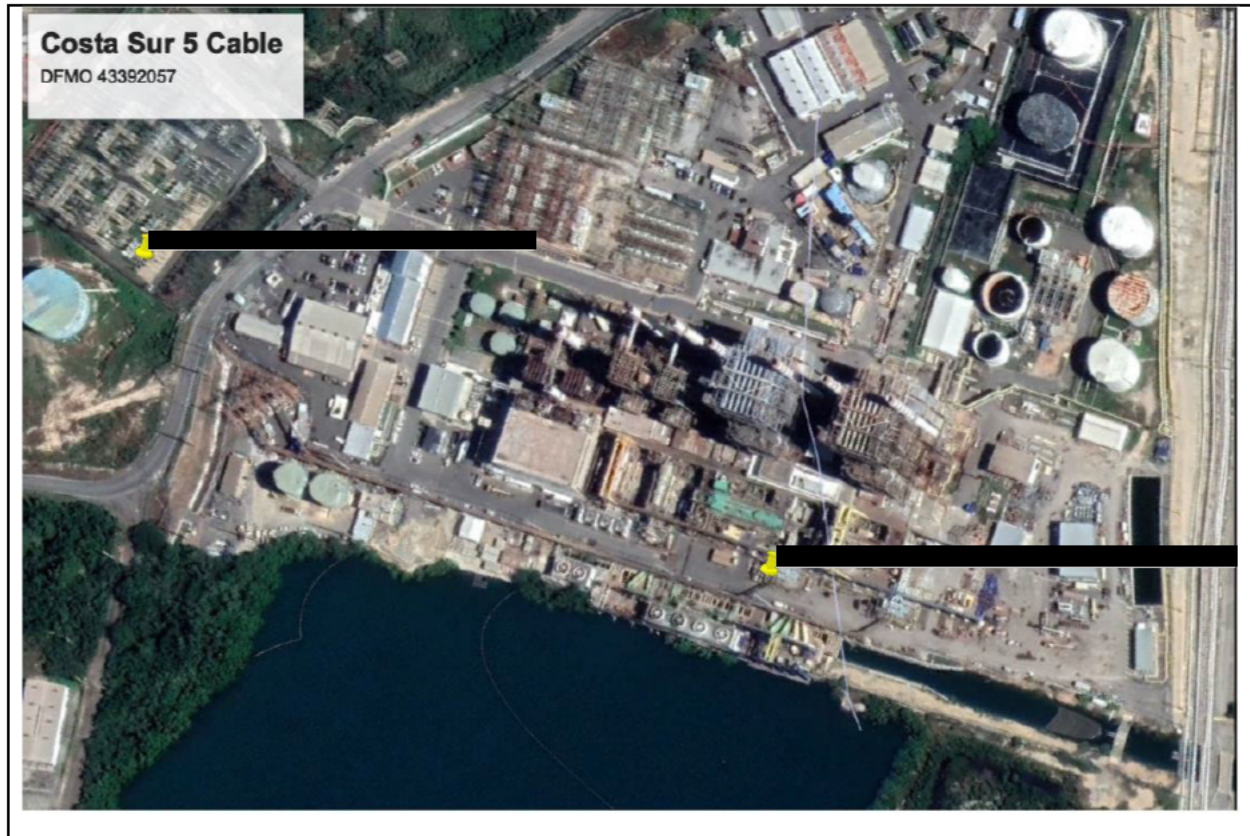
Please see attached the following:

- Justification Memo
- Scope of Work

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures



10.4. Other: (Please Describe)

N/A



GOBIERNO DE PUERTO RICO
AUTORIDAD DE ENERGÍA ELÉCTRICA

Mario E. Miranda
Jefe División de Suministros

Miguel A. Beauchamp Ramos, Jefe Interino
Central Generatriz Costa Sur

SOLICITUD DE PRECIO, REEMPLAZO DE CABLERIA SECUNDARIA 4KV TRANSFORMADORES NORMALES 5A Y 5B DE LA UNIDAD 5 CENTRAL COSTA SUR (CR 254191)

Solicitud de precio por un estimado de \$375,000.00 para remover e instalar toda la cablería secundaria calibre 1500MCM entre los transformadores normales 5A, 5B y los *switchgear*, incluyendo las terminaciones y conexiones de los cables. Se reutilizará la ruta de *conduit* soterrados y *manholes* existentes conducentes hasta los *switchgears* 4kV de la Unidad 5.

La justificación para el reemplazo de la cablería secundaria es porque está impregnada de aceite residual de los transformadores durante los pasados 30 años. El aceite deteriora la aislación de los cables y le resta la vida útil. Una falla eléctrica podría causar un incendio catastrófico que terminaría averiando los transformadores y otros equipos de la Unidad 5 de Costa Sur.

Con la nueva cablería instalada se recuperará la confiabilidad de la Unidad 5 de Costa Sur para los próximos 30 años.



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GOVERNMENT OF PUERTO RICO
PUERTO RICO ELECTRIC POWER AUTHORITY

Project number: 57

Project name: Replacement of 4160V electric cable of Normal Transformers (NSST) 5A & 5B

Estimated cost: \$250,000

Contract Requisition: 254191

Scope of work

The Normal Service Station Transformers (NSST) provide electrical power to all the auxiliary equipment of the generating unit. These step-down transformers supply 4160v to the switchgears by using three (3) underground cables for a total of nine (9) cables (1500Kcmil Insulation XLPE 5kv). The total length for both NSST is 6000 ft. The cable haven't been change since their original installation in the 1970ths so the expected useful life is overdue. In 2017 the cables of NSST 6B were changed after a failure of two of them and in 2020 the ones of the NSST 6A were replaced too. In both NSSTs, the cable's insulation were in bad condition.

The scope of this project is to purchase and install the cables during the programmed outage of unit 5 on October 2022. The delivery time is about 4 months for the cables and the installation time is 6 weeks. The replacement will bring reliability to the unit for a long term period.



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Government of Puerto Rico

Puerto Rico Electric Power Authority



Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES
Submittal to COR3 and FEMA



AGC Replacement Project Costa Sur Unit
5 & 6
1/31/2022



Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes
v. 1	1/31/2022	



Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	AGC Replacement Project Costa Sur Unit 5 & 6
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number (Formerly Project Worksheet)	136271 - MEPA078 PREPA Island Wide FAASr Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: <Name>

<Insert title here>

PREPA Project Sponsor: <Name >

<Insert title here>



Section 2. Facilities

2.1. Facilities List

Name	GPS Location
Costa Sur Power Plant AGC Replacement Project Unit 5 & 6	<div></div> <div></div>

Note: GPS coordinates are required for all facilities.

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

In the electrical grid, one of the most important issues is the frequency control. The generating units should be able to change loads to keep the frequency in a proper level (60HZ). Also, the generating units should be loaded in accord of an economic dispatch program. Thus, a controller located in Monacillos send a signal through SCADA to all the plants to position the units at the required load. The AGC of units 5 & 6 were installed in 1973 and their spare parts are no longer available. Currently, the AGC of unit 5 is not in service and the AGC of unit 6 works intermittently.



Section 3. Scope of Work

3.1. Scope of Work Description

The scope of work for Costa Sur 5 & 6 units AGC Replacement Project Costa Sur will consist of the following:

The scope of this project is to purchase and install two AGC's for a proper load regulation of units 5 & 6. The systems will be installed by August 2022.

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards:** Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project:** Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
 - a. Other improvements, not required by codes and standards
 - b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate)
<i>If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.</i>
Restores to Codes/Standards

Note: If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.

3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?



4.1. Codes, Specifications, and Standards

Yes/No. If yes, describe how incorporated below.
<ul style="list-style-type: none"> • (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE) • (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE) • Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730B-2 - U.S. Department of Agriculture Rural Electric Service (RUS) • International Building Code (IBC) - International Code Council (ICC) • International Energy Conservation Code (IECC) - International Code Council (ICC) • International Existing Building Code (IEBC) - International Code Council (ICC) • National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers • National Electrical Code (NEC) - National Fire Protection Association (NFPA) • FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.
<ul style="list-style-type: none"> • 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA) • 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA) • ASCE 7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE) • International Building Code (IBC) - International Code Council (ICC) • Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA) • Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA) • RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS) • Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.

Cost Type	Amount (\$M)
Material	\$320,000.00
Labor	\$80,000.00
Total Project Estimated Cost	\$400,000.00



Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: If available, detailed engineering cost estimates will be included as an attachment.

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

Program Manager's Printed Name

Date

Title

Signature

Section 9. PREPA Project Sponsor Comments

Comments
<Insert any comments here>

PREPA Project Sponsor's Printed Name

Date

Title

Signature

Section 10. Attachments

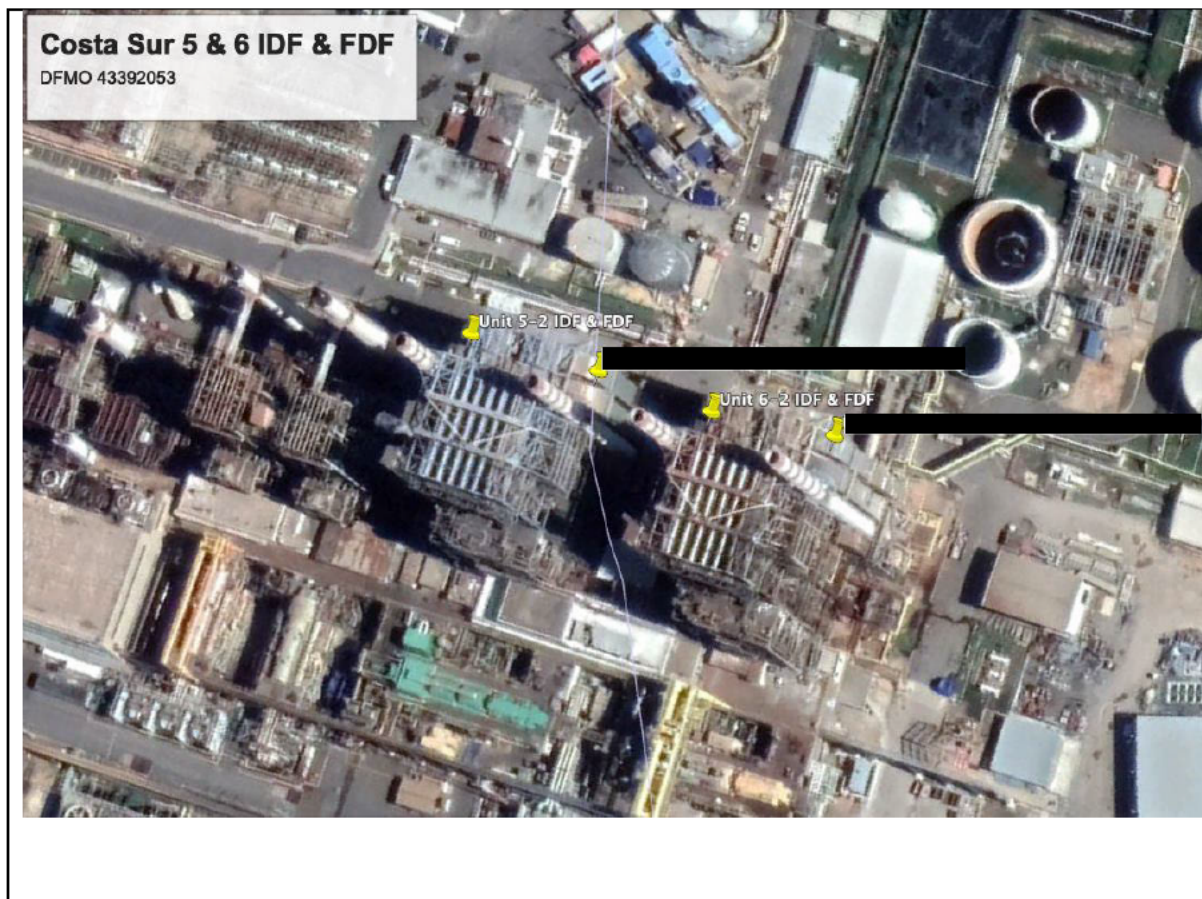
10.1. Project Detailed Cost Estimates

- Please see attached estimates.

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures





10.4. Other: (Please Describe)

N/A



GOVERNMENT OF PUERTO RICO
PUERTO RICO ELECTRIC POWER AUTHORITY

Project number: 66

Project name: AGC Replacement

Estimated cost: \$400,000

Contract Requisition:

Scope of work

In the electrical grid, one of the most important issues is the frequency control. The generating units should be able to change load to keep the frequency in a proper level (60 HZ). Also the generating units should be loaded in accord of an economic dispatch program. Thus, a controller located in Monacillos send a signal through SCADA to all the plants to position the units at the required load. The AGC is a specialized equipment located in the powerplant which receives the signal from SCADA. The AGC of units 5 & 6 where installed in 1973 and their spare parts are not longer available. Actually, the AGC of unit 5 is not in service and the AGC of unit 6 works intermittently. The scope of this project is to purchase and install two AGC's for a proper load regulation of units 5 & 6. The systems will be installed by August 2022.

Parts: \$320,000

Installation Labor- Forced Account- \$ 80,000.00

Total Costs \$400,000.000



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Government of Puerto Rico

Puerto Rico Electric Power Authority



Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES
Submittal to COR3 and FEMA



***Natural Gas Igniters for Costa Sur Units 5
and 6***

1/27/2022



Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes
v.1	1/27/2022	



Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	Natural Gas Igniters for Costa Sur Units 5 and 6
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number (Formerly Project Worksheet)	136271 - MEPA078 PREPA Island Wide FAASt Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: <Name>

<Insert title here>

PREPA Project Sponsor: <Name >

<Insert title here>



Section 2. Facilities

2.1. Facilities List

Name	GPS Location
Costa Sur Power Plant Natural Gas Igniters for Costa Sur Units 5 and 6	Unit 5 Boiler: [REDACTED] Unit 6 Boiler: [REDACTED]

Note: GPS coordinates are required for all facilities.

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

Two main components of a boiler's combustion system are burners and igniters. The existing igniters of boilers 5 and 6 are the originals of the units and are obsolete. They were not designed for the burning of natural gas. To ensure ignition reliability they must be compatible with burners that were designed and manufactured by the same company.

In recent years there have been problems with its replacement parts, in ignition, and in 2018 several electronic cards of this system broke down when replacing the UPS (Uninterruptible Power System) of the units. To this end, it is intended to replace the existing system with a state-of-the-art system designed by John Zink (COEN) and integrate it into the existing Foxboro burner control system (BMS Foxboro), which was modified for conversion to natural gas.

Given the unreliability of the existing ignition system, it is necessary to replace them with one that has the updated technology and that is compatible with the installed burners. In this case, to operate the units reliably, safely and efficiently the igniters must be designed and



manufactured by the same company that did the engineering and studies to manufacture and supply the burners to natural gas, as part of the conversion of boilers 5 and 6.

Section 3. Scope of Work

3.1. Scope of Work Description

The following is the proposed scope of work for the Natural Gas Igniters for Costa Sur Units 5 and 6 (total quantities for two boilers):

- 40* local gas trains for igniters, each including manual isolation valve, pneumatically actuated automatic double-block safety vent valve, assembled as piping spool with factory-wired junction box.
- 40* sidewall horn igniters, natural gas, 12mmBtu/hr each, including stationary high-energy spark system with replaceable spark tip, spark cable and spark exciter.
- 40* flexible metal hoses for gas igniters.
- 40* UV/IR flame scanners with cable and power supply.
- 1 BMS narrative operating sequence. Does not include BMS logic diagrams.
- Engineering evaluation of igniter and scanner air fans for capacity.
- On-site technical field advisory services, including guidance during construction, start-up, combustion tuning, and commissioning, are offered on per diem basis.

*(24 each Unit 5 and 16 each Unit 6)

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards:** Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project:** Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
 - a. Other improvements, not required by codes and standards
 - b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate)

If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.

Restores to Codes/Standards

Note: If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.



3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?

4.1. Codes, Specifications, and Standards

Yes/No. If yes, describe how incorporated below.

- (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE)
- (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE)
- Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730B-2 - U.S. Department of Agriculture Rural Electric Service (RUS)
- International Building Code (IBC) - International Code Council (ICC)
- International Energy Conservation Code (IECC) - International Code Council (ICC)
- International Existing Building Code (IEBC) - International Code Council (ICC)
- National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers
- National Electrical Code (NEC) - National Fire Protection Association (NFPA)
- FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.

- 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA)
- 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA)
- ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE)
- International Building Code (IBC) - International Code Council (ICC)
- Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA)
- Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA)
- RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS)
- Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)



Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.

Cost Type	Amount (\$M)
Materials	\$1,970,00.00
Labor	+20%
Total Project Estimated Cost	\$2,364,000.00

Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: If available, detailed engineering cost estimates will be included as an attachment.

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

Program Manager's Printed Name

Date

Title

Signature

Section 9. PREPA Project Sponsor Comments

**Comments**

<Insert any comments here>

PREPA Project Sponsor's Printed Name

Date

Title

Signature

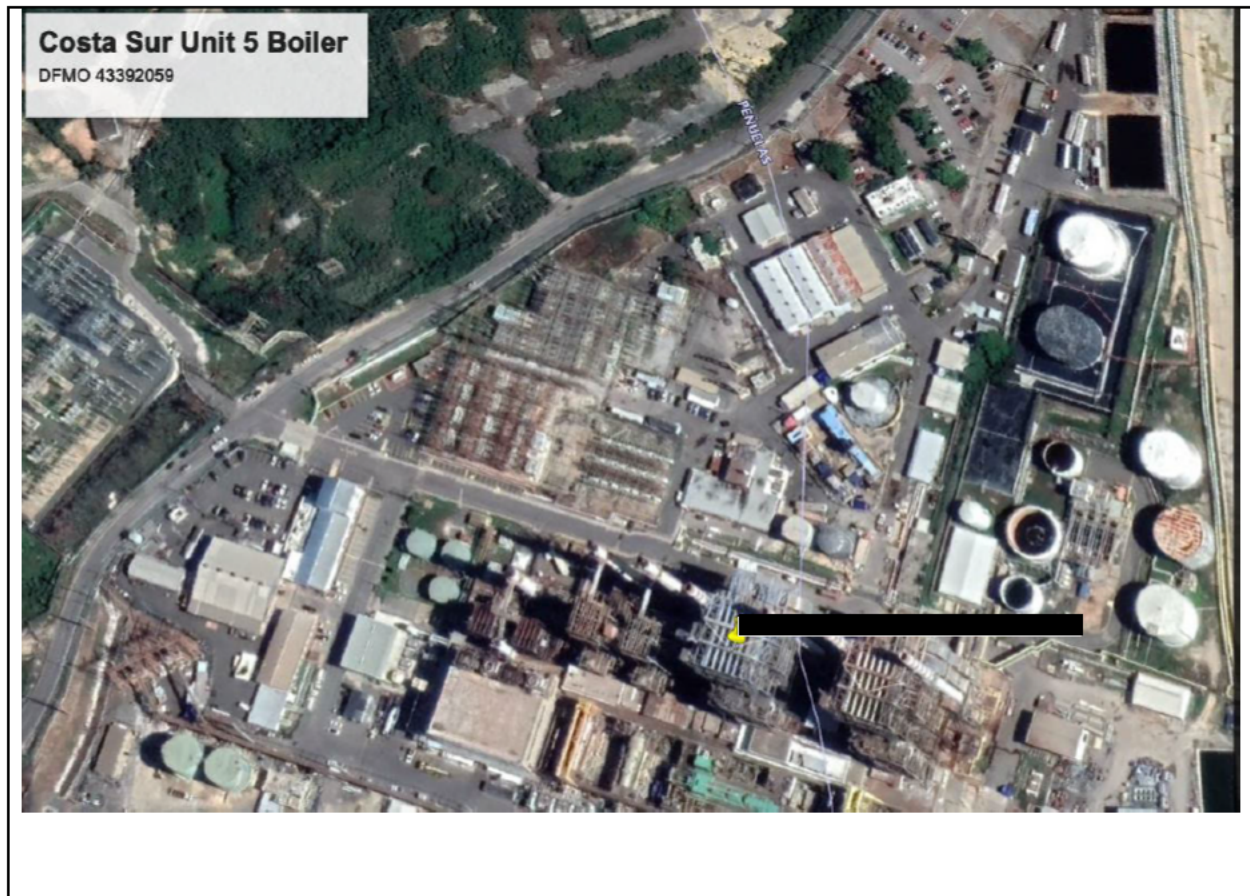
Section 10. Attachments**10.1. Project Detailed Cost Estimates**

- Please see attached to Justification Memo, and Proposal # 121119-JA for CR # 243382.

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures



10.4. Other: (Please Describe)

N/A



GOBIERNO DE PUERTO RICO

Autoridad de Energía Eléctrica de Puerto Rico

29 de junio de 2021

División de Suministros

William Ríos Mera
Director de Generación

REEMPLAZO DE SISTEMAS DE ENCENDEDORES DE LAS CALDERAS 5 Y 6 CENTRAL COSTA SUR, CR243382

Dos componentes principales del sistema de combustión de una caldera son los quemadores y encendedores. Los encendedores existentes de las calderas 5 y 6 son los originales de las unidades y están obsoletos. No fueron diseñados para la quema de gas natural. Para garantizar la confiabilidad en el encendido deben ser compatibles con los quemadores que fueron diseñados y fabricados por la misma compañía.

En los últimos años se han confrontado problemas con sus piezas de reemplazo, en encendido, y en el 2018 varias tarjetas electrónicas de este sistema se averiaron al reemplazar los UPS (Uninterruptible Power System) de las unidades. A tales efectos, se pretende reemplazar el sistema existente por uno de última tecnología diseñado por John Zink (COEN) e integrarlo al sistema existente de control de quemadores Foxboro (BMS Foxboro), el cual fue modificado para la conversión a gas natural.

John Zink es la compañía matriz de COEN. Son líderes en el desarrollo de tecnologías de sistemas de combustión aire limpio para calderas en gas natural.

En el 2010 la Autoridad contrató a COEN para realizar el proyecto piloto de conversión a gas natural de las calderas 5 y 6. Esta compañía fue la responsable de los estudios, ingeniería, diseño, modificaciones, fabricación de quemadores y otros componentes de caldera para la quema de gas natural. Para poder realizar la conversión desarrollaron los estudios y análisis termodinámicos en los componentes internos de la caldera y el CFD (Computer Flow Dynamic) en el sistema de combustión y horno para poder diseñar y fabricar los quemadores. Además, proveyó, diseño, fabricó, e integró todos los equipos, ingeniería y tecnología para estas conversiones.

Dado la poca confiabilidad que tiene el sistema de encendedores existentes, es necesario reemplazarlos por uno que tenga la tecnología actualizada y que sean compatibles con los quemadores instalados. En este caso, para operar las unidades de manera confiable, segura y eficiente los encendedores deben ser diseñados y fabricados por la misma compañía que hizo la ingeniería y estudios para fabricar y suplir los quemadores a gas natural, como parte de la conversión de las calderas 5 y 6. Hacer lo contrario representa costos adicionales por análisis y evaluaciones que otro fabricante tendría que realizar, lo que encarecerá el costo.



A tales efectos, solicitamos a COEN una propuesta para proveer un nuevo sistema con las siguientes innovaciones:

- Tres válvulas por encendedor en un arreglo conocido como doble bloqueo y venteo. Estas válvulas controlarán la entrada del combustible del encendedor a la caldera, de modo que se cumpla con el Código NPFA 87.
- Detectores de flama ópticos. Estos detectores tienen la versatilidad de que pueden ser ajustados para una discriminación de flama más precisa.
- Gabinetes de control con alambrado interno configurado para simplificar su instalación.

La propuesta recibida fue por \$1,970,000.

Según dispone el Reglamento de Subastas, Sección II: Disposiciones Generales, Artículo A: Generales, Inciso 2:

2. La Ley 83 del 2 de mayo de 1941, según enmendada, establece los casos en que no será necesario el requisito de subasta, entre éstos:

(c) Cuando se necesitan piezas de repuesto, accesorios, equipo o servicios suplementarios para efectos o servicios previamente suministrados o contratados;

De acuerdo a lo anterior y protegiendo los mejores intereses de la Autoridad de Energía Eléctrica, solicitamos la compra de los encendedores mediante una negociación directa con la compañía LT Automation, representantes en Puerto Rico de COEN. Los fondos están disponibles en la cuenta **xxxxxxx**.

Se incluye copia de la propuesta, Carta de Representación, Certificación de Fondos, y Solicitud de Autorización del Director Ejecutivo para Otorgar Contratos y/o Ordenes de Contratos u Ordenes de Servicio de \$10,000 o más.

De necesitar más información, favor de comunicarse por el 8116.

Anejos

Coordinado

Recomendado

Gerardo Sanchez Pierluisi
xxxxxxxxxxxxxx

Fernando M. Padilla Padilla
Suddirector Ejecutivo de Operaciones

Aprobado

Efran Paredes Maisonet
Director Ejecutivo



GOBIERNO DE PUERTO RICO

Autoridad de Energía Eléctrica de Puerto Rico



Apartado 364267 San Juan, Puerto Rico 00936-4267

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Proposal: 121119 JA

August 20, 2020

Engr. Ángel Pérez
Head Operation Division
South Coast Steam Plant
Puerto Rico Power Authority
Guayanilla , Puerto Rico

SUBJECT: Natural Gas Igniters for Costa Sur Units 5 and 6

Mr. Pérez:

LT Automation and the Coen Group of John Zink Hamworthy Combustion (Coen/JZHC) are pleased to provide our proposal for the Natural Gas Igniters for PREPA Costa Sur Units 5 and 6 in Guayanilla Puerto Rico.

LTA and JZHC are committed to supplying quality engineering services and equipment. Customer satisfaction is our highest priority and every effort is made to provide unparalleled service and customer support. We look forward to being of service and working with you on this project.

Please contact me with any questions or comments about this proposal.

Sincerely,

Engr. Jorge Acosta
Vice President
LT Automation, Inc.
M: 787-638-4458
E: jacostalta@gmail.com

Proposal: 121119 JA

**NATURAL GAS IGNITERS
FOR
PREPA COSTA SUR
UNITS 5 AND 6**

Prepared for:

South Coast Steam Plant
Guayanilla, Puerto Rico

August 20, 2020

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1.0 INTRODUCTION

LT Automation and John Zink Hamworthy Combustion (JZHC) are pleased to offer our engineering and equipment for natural gas igniters at PREPA Costa Sur Units 5 and 6. Each boiler has four corners of tangentially-fired tilting main burners fired with natural gas and steam-atomized heavy oil. The sidewall horn igniters are currently fired with propane/natural gas. Unit 5 has 24 igniters, and Unit 6 has 16 igniters. Each boiler is rated at approximately 450 MW gross electrical output with estimated total heat input of 4285 mmBtu/hr when firing natural gas.

1.1 Proposed Work Scope

The following Work Scope is proposed (total quantities for two boilers):

- 40* local gas trains for igniters, each including manual isolation valve, pneumatically actuated automatic double-block safety shutoff valves, pneumatically actuated automatic safety vent valve, assembled as piping spool with factory-wired junction box.
- 40* sidewall horn igniters, natural gas, 12 mmBtu/hr each, including stationary high-energy spark system with replaceable spark tip, spark cable, and spark exciter.
- 40* flexible metal hoses for gas igniters
- 40* UV/IR flame scanners with cable and power supply
- 1 BMS narrative operating sequence. Does not include BMS logic diagrams.
- Engineering evaluation of igniter and scanner air fans for capacity
- On-site technical field advisory services, including guidance during construction, start-up, combustion tuning, and commissioning, are offered on per diem basis.

* **(24 each Unit 5 and 16 each Unit 6)**

1.2 Design Data

Designation:	PREPA Costa Sur Units 5 and 6	
Boiler Make:	Combustion Engineering tangentially fired, single furnace	
Electrical Output:	Generator rated at 450 MW gross at MCR	
Burners:	Fuels:	Vaporized LNG or steam-atomized heavy oil
	Unit 5:	200 mmBtu/hr HHV per gas burner, 24 burners
	Unit 6:	300 mmBtu/hr HHV per gas burner, 16 burners
Igniters:	Fuel:	Vaporized LNG
	Unit 5:	8 to 12 mmBtu/hr each, 24 igniters
	Unit 6:	12 mmBtu/hr each, 16 igniters
Gas Supply:	50 psig supply to inlet of PCV header train (by others) 20 to 30 psig regulated supply to local igniter valve trains	
Flame Detection:	iScan2™ flame scanner	
Furnace Pressure:	Balanced draft	
Igniter Air Requirements:	Pressure:	1-5 inwc above furnace
	Airflow:	90-200 SCFM per igniter
Scanner Air Requirements:	Pressure:	5 inwc above igniter windbox
	Airflow:	5 SCFM per scanner (clean and dry)

Common Facility

Instrument Air:	Instrument Air must be clean, dry, oil free, and contaminant-free. Instrument air pressure must be supplied at 65 to 100 psig for actuation of valves and cylinders. Per ANSI/ISA-S7.0.01, the dew point at line pressure shall be at least 10°C (18°F) below the minimum temperature to which any part of the instrument air system is exposed, however the dew point at line pressure shall not exceed 4°C (39°F).
Equipment Location:	Outdoors
Enclosure Requirements:	NEMA 4 for junction box NEMA 4X-SS for enclosures with active electrical devices (switches, pushbuttons, lamps, meters, displays, etc.)
Electrical Area Classification:	Non-hazardous
Instrumentation Voltage:	120 VAC/60 Hz or 24 VDC (assumed)
Noise Specification:	≤ 85 dBA at 3 ft from major surface and 5 ft above operating floor
Ambient Air:	Relative Humidity: 0 to 100% Less than 110°F at scanner blower inlets Less than 120°F at control cabinets Less than 158°F at burners
Site Elevation:	Approximately 100 FASL
Piping Codes:	ANSI/ASME B31.1 Power Piping
Welding Requirements:	JZHC Standards
Paint:	JZHC standard
Other Codes:	NFPA 85 NFPA 497
Emissions Requirements:	Not specified for igniters

2.0 JZHC'S QUALIFICATIONS:

All equipment supplied by LTA and JZHC will be new and designed to meet or exceed the customer's specifications. The proposed equipment has been proven in many types of fired systems and will provide long-term reliability and high-quality performance.

JZHC has been designing and implementing the highest quality combustion systems for more than 100 years. Our extensive experience provides the depth of knowledge required by this project.

Our equipment is typically manufactured, assembled, and tested in John Zink Company LLC 's quality controlled, cost effective, production facility located in Tulsa OK. Other proven partner facilities may be utilized as required. John Zink's production facility has earned many exemplary certifications, including:

- ISO 9001 Certified Quality Management System, for manufacturing, order execution, contract acceptance, purchasing, vendor qualification, product development, and quality control.
- ISO 14001 Certified Environmental Management System, for managing operations to protect the health and safety of employees, customers, contractors, the public and the environment, and improving energy and resource use in its manufacturing and test center facilities.
- Occupational Health and Safety Assessment Series (OHSAS) 18001, for independent accreditation of John Zink's Safety Management System, and integration of quality, environmental, and occupational health and safety management systems.
- STAR Voluntary Protection Program (VPP), recognizing outstanding efforts at developing and implementing systems to effectively identify, evaluate, prevent and control occupational hazards to prevent employee injuries and illnesses. The three-year OSHA Total Case Incident Rate (TCIR) is 74 percent lower than the industry average; the three-year OSHA Days Away/Restricted/Transferred Cases (DART) rate is 92 percent lower than the industry average. The Tulsa site has been named a VPP Super Star and a VPP Star of Excellence site from OSHA Region IV for its safety culture. John Zink Company provides its employees with continuous safety training, resulting in a culture of accident and injury elimination.
- Award of Excellence in Safety and Health, from the Oklahoma Safety Council, and the Award of Excellence from the Oklahoma Department of Labor and the Worker Safety Policy Council.
- A National Environmental Performance Track company, as designated by the U.S. Environmental Protection Agency. Performance Track members are at the forefront of innovation and environmental stewardship, fundamentally strengthening the relationship between business and government. NEPT companies go above and beyond environmental standards to protect the environment.
- Our parent company Koch Industries has been named U.S. EPA ENERGY STAR® Partner of Year in 2015, 2016, and 2017. Of the more than 1,200 awards Koch companies have earned since 2009, this is one of the most significant. The award is the highest honor bestowed by EPA, and recognizes organizations that have made outstanding contributions to protecting the environment through energy efficiency. Over the same time period, Koch Industries was also named a top-rated company by EPA for pollution prevention initiatives.

3.0 WORKSCOPE

The following descriptions of equipment and services are provided to indicate the Workscope for conversion to gas firing.

3.1 Engineering Services

Upon receipt of order a dedicated Project Team will oversee the execution of the contract. Coen will provide complete engineering and design for all JZHC furnished equipment and materials specified in Section 3.3. Once the initial design phase is complete an engineering package submittal will be sent for customer review and approval, including:

- Project schedule
- Quality Inspection and Test Plan
- Burner General Arrangement Drawing
- Engineering Data Sheets (Mechanical and Electrical Bill of Materials)
- Burner Performance Curves
- P&ID drawings
- Burner Sequence of Operation
- BMS/Junction Boxes Layout/Wiring Diagrams
- Recommended Spare Parts List for 2-year operation

Also, JZHC will provide a comprehensive Operation and Maintenance Manual complete with operating instructions, data sheets and vendor component data/drawings in electronic PDF format. All documentation will be provided in English.

3.2 Jobsite Services

JZHC can provide field advisory services during installation, and technical assistance services during initial start-up including operator training, at the per diem rate in effect at time of request, in accordance with our standard Technical Assistance Terms. Note that NO jobsite services are currently included in our base bid.

3.3 Equipment and Materials

JZHC will provide a total of 40 sidewall horn igniters for the two boilers. There will be 24 igniters for Unit #5, and there will be 16 igniters for Unit #6.

3.3.1 Heat Input

Assuming the igniter windbox mounting flanges for the boilers are identical, then igniters will have identical design and can be interchangeable for the two boilers. To meet NFPA 85, the igniters for Unit #6 must be operated at not less than 12 mmBtu/hr HHV. However, for Unit #5, the igniters may be operated between 8 to 12 mmBtu/hr HHV by adjusting its operating pressure. Each main gas burner is 300 mmBtu/hr for Unit #6, and 200 mmBtu/hr for Unit #5. To meet the requirements of NFPA 85 Class 2 igniters, each new igniter must provide at least 4% of its associated burner's rated heat input, and the igniter can be operated continuously.

The igniter's classification per NFPA 85 is based upon the percentage of the main burner's MCR heat input, and whether continuous operation of the igniter is required. Characteristics of Class 1, Class 2, and Class 3 igniters are compared in **Table 3-1**.

3.3.2 FyrBall™ Igniters

JZHC's igniters are recommended for all applications where reliable ignition and low opacity are required, including installation in new burners, or a retrofit assembly for upgrading performance and reliability of OEM equipment. The JZHC igniter assembly features ease of installation, maintenance, and operation. Additional features are illustrated in the attached brochure.

JZHC will supply our FyrBall™ sidewall horn igniter assemblies to fire natural gas. All components on the FyrBall igniters are rigid and stationary. All components will be factory-assembled to the igniter mounting

plate, including the gas gun, flame stabilizer, high-energy electric spark rod, and flame detector. The igniters will be complete with new bolts, nuts, and gasket materials, as required.

The new FyrBall™ igniter assemblies will bolt into the existing igniter windboxes and will utilize the existing igniter combustion air supply system. The igniter assembly can be entirely removed from the windbox by personnel working from the burner deck. The fuel gun, spark rod, and flame detectors are individually removable for servicing.

All components of the JZHC igniter assemblies are manufactured with materials suitable for the specific application. Much of the assembly utilizes high temperature resistant stainless steel, and parts that are exposed to wear are appropriately hardened. All components are designed for long-life and minimal maintenance and have proven experience as JZHC's standard equipment.

3.3.3 Spark System

For excellent ignition reliability, the igniter utilizes a pulsed arc, capacitive discharge, high-energy electric ignition (HEI) Chentronics® spark system. The spark system consists of a solid-state exciter with flexible spark cable, rigid spark rod, and replaceable spark tip. The spark rod operates from a stationary position to provide reliable lightoff of the igniter fuel. The spark tip is non-fouling due to the self-cleaning nature of the intense high-energy spark. The spark rod fits through its own guide pipe, is locked in place with a cam-lock mechanism, and is separately removable for inspection or servicing.

JZHC is offering the Chentronics™ SmartSpark® exciter. The SmartSpark is an integrated exciter package which is mounted directly on the end of the spark rod, and utilizes a relatively lower voltage cable. The SmartSpark® exciter enclosure includes an external momentary diagnostic switch for testing the entire spark system, including indication when the spark tip is nearing its end of life. The spark system accepts power inputs of 100-250 VAC at 47-63 Hz.

3.3.4 Igniter Flame Detection

The gas igniter flame will be detected with a flame scanner. The igniter flame can be detected with a direct sight optical flame scanner. The iScan2™ flame scanner will be similar to the existing flame scanners for the main burners, except the fiberoptic extension (FOX) will not be necessary for the igniter, and the mounting connection will be different. The igniter flame scanner will be sighted so that it sees only the igniter flame, and therefore will have 100% discrimination from the main flame. Each igniter flame scanner will require clean purge air of 5 SCFM supplied at 5 inwc above the igniter windbox pressure (total air pressure will be similar or less than the main burner scanners, and therefore the igniter scanners can use the same air source). The existing igniter and scanner air supply systems will need to be evaluated for capacity.

3.3.5 Flexible Metal Hoses

JZHC will provide flexible stainless steel hoses for the gas supply to the igniters. The hoses will be provided with sufficient flexibility and length to accommodate the boiler thermal growth. All hoses are expected to be installed in a travelling "U" or "L" shape configuration. Lengths and end connections are selected based upon the hose diameter and growth requirements.

Table 3-1 – Comparison of Igniter Classifications per NFPA 85

NFPA 85 Classification	Class 1	Class 2	Class 3
Ignition of Main Burner	Ignite or support ignition of any credible combination of fuel and air at the main burner	Ignition only allowed under prescribed light-off conditions. Burner operated under controlled conditions to limit the charge of fuel in the event that ignition does not occur during light-off.	Small igniter applied to gas and oil burners. Ignition only allowed under prescribed light-off conditions.
Heat Input	Generally in excess of 10% of the main burner's full load heat input	Generally 4 to 10% of the main burner's full load heat input	Generally not more than 4% of the main burner's full load heat input
Continuous Operation	Yes	Permissible with two flame detectors (main flame proven independently of the igniter)	Not permissible. Igniter must be turned off after igniter's trial for ignition period
Trial for Ignition Period	10 seconds for gas or #2-4 oils 15 seconds for #5-6 oils	10 seconds for gas or #2-4 oils 15 seconds for #5-6 oils	10 seconds for gas or #2-4 oils 15 seconds for #5-6 oils
Extended Operating Range	Support combustion of the main flames under any burner light-off or operating conditions, including low loads or adverse conditions, and may extend the operating range (turndown) of the main burners	Cannot be used to ignite main fuel during uncontrolled or abnormal operating conditions. Can be used to support the ignition under low-load or adverse operating conditions. Cannot be used to extend the turndown range of the main burner.	Cannot be used to support ignition or extend the turndown range of the main burner. Cannot be used for simultaneous dual fuel firing within the same burner (e.g., during fuel transfer).
Flame Detection	One detector to prove either the igniter or main flame. Igniter flame detector is required to prove "flame not detected" before lighting, unless its burner is proven in service. Burner flame detector is not required to prove "flame not detected" if its igniter is proven in service. Igniter must prove "flame detected" before admitting main fuel.	If continuous operation of igniter is required while main burner is in operation, then two detectors must prove igniter and main burner independently. Igniter flame detector is required to prove "flame not detected" before lighting, unless its burner is proven in service. Igniter must prove "flame detected" before admitting main fuel.	One detector required for main burner and igniter. Igniter flame detector is required to prove "flame not detected" before lighting, unless its burner is proven in service. Igniter must prove "flame detected" before admitting main fuel.
Master Fuel Trip (MFT) Requirement	Failure of the first Class 1 igniter to light or its flame to be proven does not require MFT, but requires 1-minute delay before restart. MFT is not required if Class 1 igniters remain in service when all burners tripped. MFT is always invoked upon loss of <i>all</i> flames.	Failure of the first Class 2 igniter to light or its flame to be proven does not require MFT, but requires 1-minute delay before restart. MFT shall be initiated on failure to ignite the first main burner in service within 5 seconds after fuel enters the furnace, or upon abnormal shutdown of last main burner in service. MFT not initiated if last burner is taken out of service in normal shutdown, and proven igniter(s) remain in service. MFT is always invoked upon loss of <i>all</i> flames.	Failure of the first Class 3 igniter to light or its flame to be proven does not require MFT, but requires 1-minute delay before restart. MFT shall be initiated upon failure to ignite the first main burner within 5 seconds after fuel enters the furnace, or upon loss of ignition for the first main burner in service, or for any loss of flame for the last main burner in service. MFT is always invoked upon loss of <i>all</i> flames.
Burner Trip Requirements Upon Loss of Flame	Tripping of main burner is not required if the associated Class 1 igniters remain in operation. (Not recommended with sidewall igniters due to geometry)	Loss of main flame at <i>any</i> main burner shall trip that burner, even if igniter flame is detected (except if fireball logic is active).	Loss of main flame at <i>any</i> main burner shall trip that burner, even if igniter flame is detected (except if fireball logic is active).
Other	Proof of closure required for individual igniter shutoff valves ≥ 5 mmBtu/hr, multiple burners only	Proof of closure required for individual igniter shutoff valves ≥ 5 mmBtu/hr, multiple burners only	Proof of closure required for individual igniter shutoff valves ≥ 5 mmBtu/hr, multiple burners only

3.4 Valve Trains

JZHC will supply double-block-and-vent valve trains for each igniter to meet the requirements of NFPA 85 latest version (currently 2019). Each local valve train will include the following components:

- Inlet manual isolation valve
- Particulate strainer
- Upstream safety shutoff valve, pneumatically actuated, fail close, with 2-SPDT switches (Class I, Div. 2)
- Safety vent valve, pneumatically actuated, fail open, with 2-SPDT switches
- Downstream safety shutoff valve, pneumatically actuated, fail close, with 2-SPDT switches
- All components factory assembled into piping spools (no structural support rack)
- Junction box, wired to all electrical devices
- Instrument air manifold, with isolation valves and air filter regulators for each pneumatic device

LTA and JZHC are not supplying pressure control valves, header safety shutoff valves, header vent valves, pressure relief valves, any instrumentation, interconnecting piping, or installation. Piping component sizes and descriptions provided herein are preliminary and may be revised during JZHC's project engineering.

All gas fuel piping will be designed to ASME B31.1 power piping and fabricated from ASTM A106 Grade B seamless carbon steel pipe. Piping NPS 2 or smaller will be Schedule 80 with socket weld Class 3000 or better fittings. Piping NPS 2.5 or larger will be Schedule 40 with standard weight butt-weld fittings. Wherever disconnecting is necessary, connections NPS 1-1/2 or smaller will have threaded pipe or JIC swivel nuts, or 150 lb raised face flanges for NPS 2 or larger.

Fuel shutoff valves will each have carbon steel body, SS ball, and SS stem. Where position interlocking of the valve is required for the BMS, mechanical limit switches with two SPDT mechanical switches will be provided. Fuel block valves will be bubble tight shutoff in accordance with ANSI/FCI 70-2 Class VI, and Fire-Safe in accordance with API 607 Edition 4 or latest version. The rated service pressure of each shutoff valve will be at least equal to the pressure rating for its flanges. Instrument air lines will be stainless steel tubing. Instrument air will be locally filtered and pressure regulated, with manual isolation valves to individual devices.

Each of the proposed valve spools will include a factory-wired junction box and instrument air manifold. All electrical components will be wired to numbered terminals in the mounted terminal panel.

Unless otherwise noted, the interface points are the inlets and outlets of the valve trains, the discharges of blowdown or drain valves, inlet of instrument air manifold, outlet of the manual vent manifold, and the electrical terminals.

JZHC will supply equipment as factory-assembled to the maximum extent feasible. The following assumptions are made for the assembled valve trains:

- All pre-fabricated valve trains shall be configured and manufactured at the same time. Left-hand and right-hand arrangements, as requested, of functionally similar trains are permissible.
- All other engineering, materials, and installation shall be provided by others, including header valve trains, interconnecting piping between valve trains or to igniters, vent piping, blowdown or drain piping, support steel, heat tracing, insulation, lagging, piping supports, piping expansion joints, etc. All onsite installation will be provided and paid for by others.

JZHC will prepare P&ID schematics, dimensioned general arrangement drawings, and installation instructions for the valve train assemblies. JZHC's valve train assembly drawings will provide plan and elevation views, in AutoCAD or other exchangeable format, and will be suitable for integration by others into the general plant arrangement drawings. Customer instrument tag numbers will be included on JZHC's drawings if the tag numbers are provided by the customer. JZHC's installation instructions may be in the form of drawings or narrative documentation, and will be transmitted electronically for approval.

To assure fuel flow uniformity, JZHC will provide recommended diameters for the interconnecting piping from the fuel supply header to the individual igniter valve trains, and from the individual valve trains to the igniters. JZHC is not providing any physical arrangement drawings, detailed fabrication drawings, or other drawings suitable for fabrication or installation of interconnecting piping. JZHC will provide one

review and set of comments for the general physical arrangement drawings as prepared by others for the interconnecting piping upstream of the header inlets, the interconnecting piping between valve trains, and the interconnecting piping to the igniters or burners.

3.5 BMS Engineering

JZHC will supply a narrative sequence of operation for the burner management system (BMS). BMS engineering logic and BMS hardware and wiring will be by LT Automation.

The written narrative sequence of operation will provide general guidance for startup, operation, monitoring, and shutdown of all affected combustion equipment. The sequence will describe proper procedures for boiler purge, safe ignition of pilot (if any), safe ignition of the main fuel(s), and shutdown. The sequence will address the proper lightoff and relighting procedures for igniters and burners, effects of partial or total shutdown, and the effects of combustion equipment failures and other events related to safe operation of the combustion system. The system will include "DO" and "DO NOT" where applicable for safe system operation, and will include effects and remedies of uncontrolled trips, and recommended procedures for a controlled shutdown.

I/O list, alarm list, and trip set point list will be provided during design engineering.

3.6 Exceptions and Clarifications

3.6.1 General Exceptions

The following engineering, equipment, and services are NOT included in our base proposal:

- Any gas handling equipment upstream of JZHC's local valve skids, including:
 - isolation valves
 - fuel-switching valves
 - particulate filters or liquid coalescers
 - flowmeters
 - pressure control valves (PCVs)
 - pressure relief valves
 - header safety shutoff valves
 - header safety vent valves
 - instrumentation
- Local control panels
- Mechanical Installation
- Igniter combustion air fans, windboxes, discharge horns (we plan to reuse the existing items)
- Analyses or modifications to foundations or structural supports
- Instrument air supply system
- DCS engineering, logic, programming, specification, hardware, or implementation
- Equipment for detecting or suppressing fuel leaks, smoke, heat, or fires.
- Interconnecting piping, tubing, conduit, or wiring
- Any materials or labor for abatement, demolition, removal, disposal, loading, unloading, storage, handling, installation, modification, operation, calibration, adjustment, or maintenance of any equipment, regardless of whether the equipment was supplied or not supplied by JZHC, except if such materials or labor are specifically identified in this proposal as included in JZHC's workscope. It has been assumed that all such unspecified materials and labor will be independently provided and paid for by others, or will be the subject of future proposals.

3.6.2 Clarifications

- Where there is limited information available, JZHC will verify Owner's drawings and/or take field measurements sufficient for design and performance of JZHC's equipment. The owner must provide timely access to the units. Field measurements will be charged using JZHC's applicable *Technical Assistance Agreement*.

- JZHC's fuel safety shutoff valves will close within 1 second in compliance with NFPA 85. The *opening* rates of the shutoff valves may be intentionally speed controlled to improve lightoff and controls system response.
- JZHC will provide P&IDs and arrangement drawings only for new equipment supplied by JZHC. We are not updating existing drawings.
- A list of recommended spare parts will be developed during project engineering.

3.7 Additional Work Supplied by JZHC

In addition to the above described materials and services, JZHC will supply:

- The services of the assigned JZHC project engineer for each of the following meetings:
 - One project kick-off meeting by telephone
 - One design review meeting by telephone
 - One equipment acceptance test at JZHC's manufacturing shop
- All design engineering and project management for the equipment supplied by JZHC, with project documentation submitted electronically on a timely basis per the Contract milestones, including:
 - Arrangement drawings for approval
 - Bill of materials for approval
 - Project schedules
 - Equipment inspection and test plans (ITPs)
 - Recommended spare parts list
 - Installation, operation, and maintenance (IOM) manual submitted prior to shipment of the equipment, which will be sufficient for initial installation, checkout, startup, operation, shutdown, and maintenance of the equipment designed or supplied by JZHC. This proposal includes two (2) electronic copies on CD or memory stick. Subsequent copies may be provided for a nominal additional price. JZHC's customer, end user, and/or their designees are permitted to make unlimited copies of IOM documentation for distribution exclusively to end user.
 - Customer's instrument tag numbers will be included on JZHC's documentation if the tag numbers are provided by the customer.
 - All electronic documentation will be provided as PDFs or TIFs. Some documents may also be provided in other formats, as specified by the Contract.
- Accessibility will be provided to JZHC's customer, the end user, and/or their designees to witness QA and QC testing, or Factory Acceptance Testing, at JZHC's manufacturing facilities, to inquire about project schedule, and to occasionally observe progress of key project assemblies on the production floor. JZHC will provide notice to our customer at least 10 working-days prior to anticipated readiness for witness and hold points, and for QA and QC testing. Each burner assembly will be subjected to QA and QC testing, and each burner assembly will be provided with written documentation of the test results.
- Each assembly will be built into the most complete and largest practical sizes to minimize field erection time.
- JZHC will package the proposed equipment into sea or land crating, as appropriate. The terms for freight are described in the Pricing Terms Section of this proposal.

3.8 Field Services

JZHC recommends utilizing our on-site field services during the installation, checkout, startup, tuning, commissioning, and operator training of JZHC's equipment. Field service activities performed by JZHC will be specifically limited to the servicing of JZHC supplied equipment and only as authorized by the plant. Due to inherent variability of field service activities, all JZHC field services will be invoiced for actual hours and expenses, and at the labor rates in effect when services are requested, in accordance with JZHC's applicable *Technical Assistance Agreement*. JZHC Field Service invoice rates are typically adjusted not more than once per year. **Field services are NOT included in the base price.**

For scheduling of field services, please contact our Field Service Coordinators at 650-522-2100 or 650-522-2114 during normal business hours. Call after-hours hotlines 800-445-0912 (Coen) or 800-755-4252 (John Zink).

3.9 Required Information

The following design information will be required from the customer for completing engineering design:

- Confirmation of all operating and design parameters in Section 1.2.
- Thermal expansion data (vertical and horizontal) for the boiler to develop design specifications for the flexible connections (e.g., hoses, conduits). Thermal expansion data is typically supplied on a boiler elevation drawing, or physically indicated at the boiler base.
- Copies of P&IDs, electrical schematics, and BMS logic of the existing igniter systems, and plan and elevation views of equipment. Other drawings and design information may also be required of the existing equipment, including but not limited to specifications for flows, pressures, temperatures, voltages, power, and noise.
- Station drawings are preferred to be received in AutoCAD, PDF, TIF or other readily electronically exchangeable format.

4.0 SCHEDULE

For the proposed work-scope, the elapsed durations from arrival of an acceptable purchase order until availability for shipments are estimated at 16 to 20 weeks for igniters, and 24 weeks for local valve trains (DB&Vs), plus time required by customer for review of JZHC drawings. To shorten our delivery dates, it is recommended to purchase front-end engineering design from JZHC.

The actual project schedule is dependent upon receipt of a valid purchase order and suitable design information. Durations proposed herein are based upon our sub-suppliers standard delivery times, and assumed timely customer's review of JZHC submittals. Partial shipments may be possible at earlier dates but requires confirmation with the factory. Transit times and freight from Tulsa's shop to customer are not included, and must be added to the schedule above. Prior to receipt of JZHC equipment on site, the installation contractor may choose to fabricate and install any structural modifications, interconnecting piping, foundations, etc. A confirmed project schedule will be issued within about 2 weeks after JZHC's acceptance of the customer's purchase order.

5.0 COMMERCIAL

5.1 Prices

The following prices are based upon the design conditions, work scope, and schedule as described within this proposal. There will be 24 igniters supplied for Unit #5, and there will be 16 igniters for Unit #6.

Product Name	Price USD for Qty 24 each (Unit #5)	Price USD for Qty 16 each (Unit #6)
Flame Scanners, iScan2™ UV/IR, power supply, air hose, 15' cable Igniters, 12 mmBtu/hr, spark system, 15' cable, gas hose local valve trains, with junction box, support racks for local valve trains		
TOTALS:	////////////////////	USD\$1,928,000

5.2 Pricing Terms

This proposal is subject to the following Terms and Conditions.

- Prices are in U.S. Dollars.
- Prices do not include any taxes.
- Prices do not include any costs for any insurance, bonding, letters of credit, or bank guarantees.
- Equipment prices do not include spare parts, except as may be supplied at JZHC's sole discretion for consumption during commissioning, or that may be quoted separately.
- Equipment prices include preparation for shipment, including appropriate packing and crating.
- JZHC products may be manufactured at any locations at JZHC's sole discretion. For this project, JZHC expects to perform all manufacturing within the USA.
- Equipment prices do not include on-site Technical Assistance (field services). JZHC field services will be invoiced per their actual hours and expenses, per JZHC's *Technical Assistance Agreement*. Invoices for JZHC Technical Assistance will be based upon the labor rates in effect on the dates that services are performed. JZHC Technical Assistance labor rates are generally adjusted not more than once per year.
- All prices are valid through scheduled delivery of all JZHC supplied equipment, provided JZHC accepts a Purchase Order or a Letter of Intent within **30 days** of this proposal. Thereafter, JZHC reserves the right to re-quote the price.

5.3 Payment Milestones

The following invoice and progress payment schedule is required:

- 20% of Equipment Price upon acceptance of Purchase Order
- 20% of Equipment Price upon engineering submittal
- 20% of Equipment Price at 6 weeks after engineering submittal
- 35% of Equipment Price upon notice of availability for shipment. All payments must be fully received before shipment.
- 5% of Electrical Installation
- Payment of all invoices shall be Net 30 days

6.0 PERFORMANCE GUARANTEES

The following general notes are applicable to JZHC's Performance Guarantees.

- 1) All performance specifications stated throughout this proposal are intended to show probable operating results only which cannot be guaranteed except as expressly stated within this Section.
- 2) All Performance Guarantees apply when firing only the JZHC-supplied equipment with the subject fuel type(s) and/or fuel constituents as proposed herein.
- 3) Testing for JZHC Performance Guarantees shall be run within **24 weeks** after equipment has been shipped, or **12 weeks** after the equipment has been installed and first operated, whichever occurs earlier. Prior to testing, a JZHC trained service engineer shall tune JZHC's equipment to assure that Performance Guarantees can be met during the Performance Tests. Performance Tests will be conducted at steady state operating conditions, and in a manner to ensure that the specified operating conditions are being maintained. JZHC will be allowed to observe the Performance Testing and will be supplied a complete copy of all test data and results. Others shall supply all operating personnel and equipment for such tests, including development of test protocols for regulatory submittal, supply of all consumables (fuel(s), etc.), stack emissions sampling, acquisition and analyses of fuel samples by a qualified independent test laboratory (including trace fuel bound nitrogen (FBN) using acceptable analytical method), data reduction, and reporting.
- 4) The JZHC equipment shall be considered accepted if the Performance Tests show that the Performance Guarantees have been fulfilled, or if the equipment is not tested within the specified period. In case of the failure to meet the Performance Guarantees, JZHC shall be provided with ample opportunity to analyze the circumstances, and to perform a reasonable correction. JZHC reserves the right to modify, change, or replace, on a straight time basis, the furnished equipment so that Performance Guarantee(s) will be obtained.
- 5) JZHC Performance Guarantees are valid only when the equipment is installed, operated, and maintained specifically according to the following (listed in order of decreasing precedence):
 - a) Safe operating practices,
 - b) JZHC's IOM instructions,
 - c) JZHC's Engineering Design Basis determined during project engineering, and
 - d) Design Data as specified in this proposal.
- 6) For boilers with the furnace and generating bank separated by furnace tubes (including but not limited to packaged boilers and HTHW generators), the furnace tubes must form a gas tight seal to prevent short circuiting of furnace gases into the boiler gas outlet.
- 7) Prior to emissions testing, all boiler/heater fireside surfaces must be thoroughly pressure washed, such that all loose debris is removed from the windbox, generating tubes, superheater, economizer, airheater, and duct surfaces.
- 8) Dimensional drawings and/or confirmations of all boiler/heater properties are required for validation of Performance Guarantees, including: existing burner arrangements, internal furnace dimensions, tube wall openings, and refractory locations.

6.1 Heat Input

JZHC guarantees that the fuel supply equipment and igniters will deliver up the heat inputs stated in **Section 1.2**, when firing the specified fuel(s) and pressure(s) supplied at the igniter inlets.

6.2 Stack Opacity

JZHC guarantees that incremental stack opacity will be less than 10% while firing only JZHC igniters. Incremental opacity is defined as the measured opacity (6-minute rolling average in stack) during igniter or burner operation, minus the baseline opacity (6-minute rolling average in stack, in the period immediately before initiating operation of JZHC igniters or burners).

6.3 Noise

JZHC guarantees that the noise levels from JZHC's equipment will not exceed 85 dBA when measured at 3 feet from major surfaces of the equipment and/or enclosures, and at 5 feet height above the nearby operating floor, based upon each point source measured independently in a free field, during steady state operating conditions, excluding reflections, after subtracting background noise, and exclusive of abnormal, startup, shutdown, and emergency conditions.



John Zink Company LLC
11920 East Apache Street
Tulsa, Oklahoma 74116
United States

T : +1.918.234.1800
F : +1.918.234.2700

August 20, 2020

LT AUTOMATION, INC.

374 Ave. De Hostos

Urb. Roosevelt

San Juan, PR 00918

Subject: Letter of Exclusive Product Distribution Agreement – Puerto Rico

TO WHOM IT MAY CONCERN:

This letter is to certify that the firm known as LT Automation, Inc., with headquarters in San Juan, Puerto Rico, located at the above indicated address, is the authorized and **exclusive** product distributor for **John Zink Company LLC.**, for the territories of **Puerto Rico** entailing **Coen, Todd, and Hamworthy Peabody** brands and products in the power generation/utility markets.

Any aftermarket parts for the territory and market described in this letter can only be marketed and/or sold through our distributor, LT Automation, Inc., exclusively.

As per the current distributor agreement between John Zink Company, LLC and LT Automation, Inc., this letter of exclusivity is valid through June 30, 2023.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Alan Gerber', written over a horizontal line.

Alan Gerber

Director, Latin America Sales

John Zink Company LLC

Email: alan.gerber@johnzink.com

Telephone: 972-335-0110

Mobile: 214-679-0986

Government of Puerto Rico

Puerto Rico Electric Power Authority



Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES
Submittal to COR3 and FEMA



Palo Seco Steam Plant

New Water Condensate 1-2 Tank

11/29/2021



Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes



Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	New Water Condensate 1-2 Tank
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number (Formerly Project Worksheet)	136271 - MEPA078 PREPA Island Wide FAASt Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: <Name>

<Insert title here>


PREPA Project Sponsor: <Name >

<Insert title here>



Section 2. Facilities

2.1. Facilities List

Name	GPS Location
<i>Palo Seco – Water Condensate Tanks 1 & 2</i>	

Note: GPS coordinates are required for all facilities.

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

This project related to Palo Seco – New Water Condensate Tanks 1 & 2 -is necessary to provide water for the steam cycle which allows the power plant to be more reliable. The tank in question reflects an advanced state of corrosion and several bent sections, compromising its long-term integrity and reliability. Based on the foregoing, the Central understands that the best alternative is to replace the tank as soon as possible.

Section 3. Scope of Work

3.1. Scope of Work Description

The Contractor shall furnish and provide all engineering, design, labor, equipment, materials and supervision required to successfully build a New Condensate Water 1/2 at Palo Seco Steam Plant. The scope includes, but is not limited to, the demolition of the existing tank,



design and build of a new tank. The Contractor shall perform a subsoil exploration to determine soil bearing capacity and site seismic classification.

The dimension of the new tank shall be like the existing (D=35 ft. H=24 ft.). The new tank shall be fitted with a spiral stairway, self-supported umbrella roof, top platform (10 ft. x 6 ft.), top catwalk to access adjacent tank roof, level indication, level transmitter, grounding, tank identification, etc. Tank design shall be based on the latest revision of API-650 code. A complete internal and external coating system shall be applied. The internal system shall be based on a reinforced high build novolac epoxy lining. The external shall be based on a three coat system consisting of: (1) a metallic zinc rich epoxy primer, (2) two component low VOC high build self-priming, surface tolerant, lamellar aluminum flakes reinforced, epoxy mastic and finished with (3) a two component, high solids, low VOC, abrasion resistance, high gloss epoxy siloxane.

The work includes lead abatement procedures and disposition, installation of all the protection systems and replacement of any connection piping to tank.

All work as described above shall be complete in One Hundred Twenty (120) calendar days starting after the issuance of the Notice to Proceed (NTP). A daily penalty of one thousand five hundred dollars (\$1,500) shall be applicable for each day of delay after the one hundred twenty (120) days of the completion of the Work term, up to a maximum of 10% of the contract value.

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards:** Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project:** Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
 - a. Other improvements, not required by codes and standards
 - b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate)
<i>If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.</i>
Restores to Codes/Standards

Note: If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.

3.3. Preliminary Architectural and Engineering (A&E)



Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?

4.1. Codes, Specifications, and Standards

Yes/No. If yes, describe how incorporated below.

- (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE)
- (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE)
- Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730B-2 - U.S. Department of Agriculture Rural Electric Service (RUS)
- International Building Code (IBC) - International Code Council (ICC)
- International Energy Conservation Code (IECC) - International Code Council (ICC)
- International Existing Building Code (IEBC) - International Code Council (ICC)
- National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers
- National Electrical Code (NEC) - National Fire Protection Association (NFPA)
- FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.

- 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA)
- 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA)
- ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE)
- International Building Code (IBC) - International Code Council (ICC)
- Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA)
- Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA)
- RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS)
- Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.



Cost Type	Amount (\$M)
Removal, design and fabrication (& other labor related) of new 173,000 gallons steel water condensate tank	\$1,000,000.00
Total Project Estimated Cost	\$ 1,000,000.00

Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: If available, detailed engineering cost estimates will be included as an attachment.

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

Program Manager's Printed Name

Date

Title

Signature

Section 9. PREPA Project Sponsor Comments

Comments



<Insert any comments here>

PREPA Project Sponsor's Printed Name

Date

Title

Signature

Section 10. Attachments

10.1. Project Detailed Cost Estimates

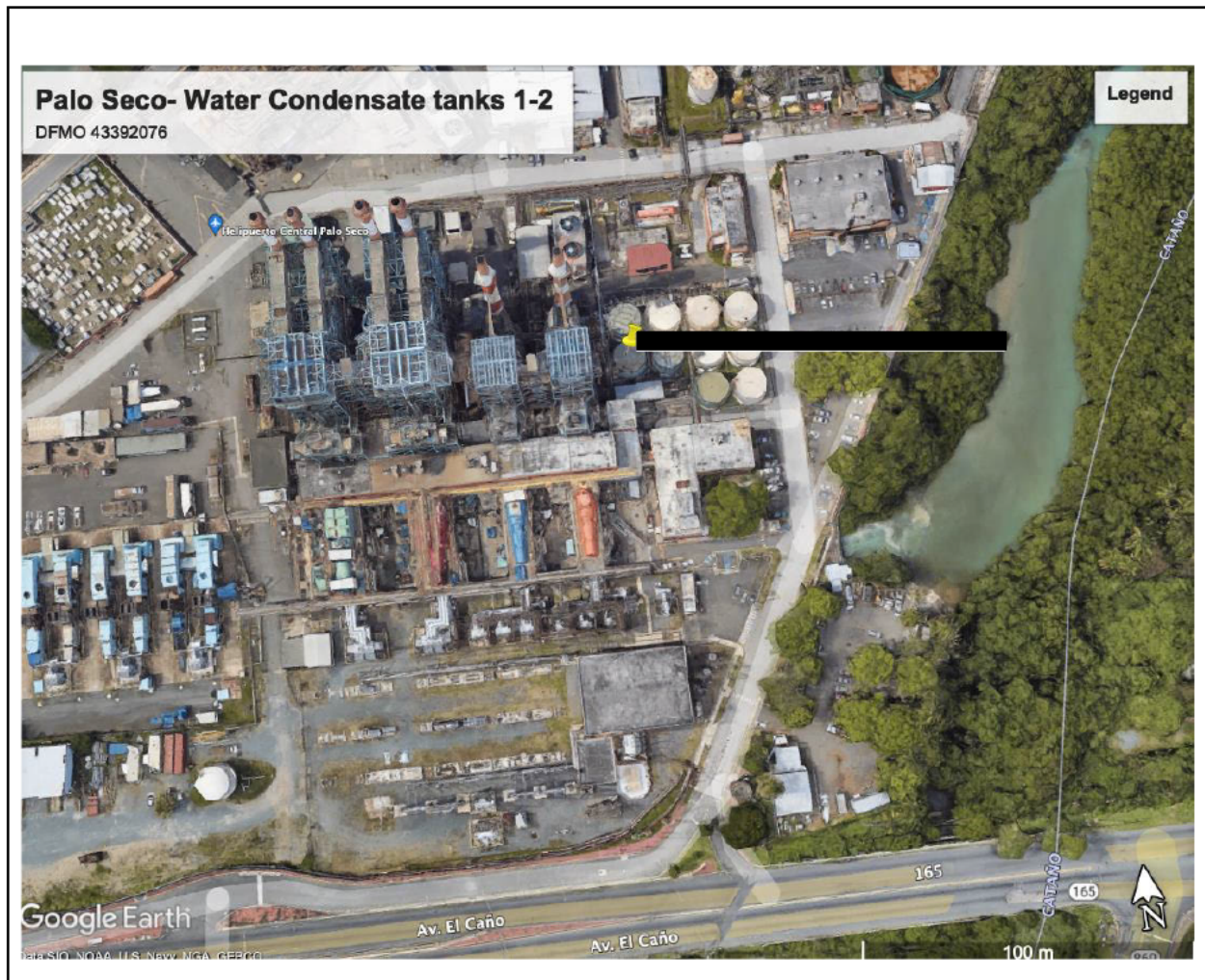
Please see attached the following supporting documentation:

- SOW NARRATIVE
- Proyectos Críticos Central Palo Seco (Número de Proyecto PREB) [1]
- 15010 - Special Conditions Preliminary Draft New Condensate Tank 1-2 Palo Seco_PREB_4076

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures



10.4. Other: (Please Describe)

N/A

Scope of Work

The Contractor shall furnish and provide all engineering, design, labor, equipment, materials and supervision required to successfully build a New Condensate Water 1/2 at Palo Seco Steam Plant. The scope includes, but is not limited to, the demolition of the existing tank, design and build of a new tank. The Contractor shall perform a subsoil exploration to determine soil bearing capacity and site seismic classification.

The dimension of the new tank shall be like the existing (D=35 ft. H=24 ft.). The new tank shall be fitted with a spiral stairway, self-supported umbrella roof, top platform (10 ft. x 6 ft.), top catwalk to access adjacent tank roof, level indication, level transmitter, grounding, tank identification, etc. Tank design shall be based on the latest revision of API-650 code. A complete internal and external coating system shall be applied. The internal system shall be based on a reinforced high build novolac epoxy lining. The external shall be based on a three coat system consisting of: (1) a metallic zinc rich epoxy primer, (2) two component low VOC high build self-priming, surface tolerant, lamellar aluminum flakes reinforced, epoxy mastic and finished with (3) a two component, high solids, low VOC, abrasion resistance, high gloss epoxy siloxane.

The work includes lead abatement procedures and disposition, installation of all the protection systems and replacement of any connection piping to tank.

All work as described above shall be complete in One Hundred Twenty (120) calendar days starting after the issuance of the Notice to Proceed (NTP). A daily penalty of one thousand five hundred dollars (\$1,500) shall be applicable for each day of delay after the one hundred twenty (120) days of the completion of the Work term, up to a maximum of 10% of the contract value.

SECTION 15010
SPECIAL CONDITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This section includes: PREPA drawings, general contract provision, supplementary conditions, inspection reports, and other technical sections.

a) The following additional sections are part of this specification:

- i. Section 03300 – Concrete Work
- ii. Section 03370 – Grouting
- iii. Section 05100 – Structural Steel Framing
- iv. Section 05500 – Metal Fabrications and Castings
- v. Section 09800 – Fabric Reinforced Plastic Liner
- vi. Section 09900 – Paint
- vii. Section 15455 – Storage Tank
- viii. Section 15456 – Hazard Material Procedure Handling
- ix. Section 15457 – Confined Space

b) PREPA's Drawings

Demi Water Tank #4 Rehabilitation

- i. Sheet 1 – Piping System Existing Conditions
- ii. Sheet 2 Rev.1 – Piping System Modifications
- iii. Sheet 3 Rev.1 – Piping System Final Conditions

c) Annexes (as published, additions may occur during pre-bid)

- i. Annex 1 – Color Code and Tank Label

- ii. Annex 2 – Tank Grounding
- iii. Annex 3 – Tank Inspection Report (09-10-2013)
- iv. Annex 4 – Equipment and Material List Procured by PREPA
- v. Annex 5 – Products
- vi. Annex 6 – Lead Sampling Report

1.2 SUMMARY

- A. Scope of work: Work shall include all labor, materials, equipment, tools, supervision, and services for the design and build of the New Condensate Water Tank #1-2 at Palo Seco Steam Plant. The scope includes, but is not limited to, the demolition of the existing tank, design and build of a new tank. The dimension of the new tank shall be similar to the existing (D=35 ft. H=24 ft.). The new tank shall be fitted with a spiral stairway, self-supported umbrella roof, top platform (10 ft. x 6 ft.), level indication, level transmitter, grounding, tank identification, etc. Tank design shall be based on the latest revision of API-650 code. A complete internal and external coating system shall be applied as per specifications. Contractor shall be responsible for all required rigging, safety, permits and the appropriate store of the coatings, grit blast material, and equipment. The project completion period shall be one hundred eighty (180) calendar days with a delay penalty of two thousand dollars (\$2,000) per calendar day after the project completion period to a cumulative maximum of 10% of the total contract value.
- B. All works shall be performed in a safe and workmanlike manner and in conformance with Codes, Standards, Local Rules, Regulations and Ordinances, etc. of government agencies having jurisdiction, including but not limited to the following:
 - a) The Environmental Protection Agency (EPA)
 - b) The Office of Safety and Health Administration (OSHA) requirements
 - c) ACI -318 (latest revision)
 - d) Environmental Quality Board
 - e) American Petroleum Institute API - 2610 Design, Construction Operation, Maintenance & Inspection of Terminal and Tank Facilities

- f) NFPA-30- Flammable and Combustible Liquid Code
 - g) 29 CFR 1910, 40 CFR 112 (latest revision)
 - h) American Society for Testing and Materials, ASTM
 - i) EPA NPDES Permit for Palo Seco Steam Plant
- C. All analysis shall be made by a PREPA-approved laboratory.

1.3 REQUIRED DOCUMENTS

- A. Bidders shall submit evidence of required experience of at least five (5) years in related works. The required experience shall be a list of similar projects (past or ongoing) where the following conditions are or were met:
- a) Full enclosure of working area
 - b) Sandblasting of metal surfaces and capacity (CFM) of the compressor used for the work.
 - c) Use of airless spray or plural component equipment. Specify if equipment was rented or own by the company.
- B. Contractor shall provide a work schedule for the project. This schedule will be reviewed and approved by the Engineer prior to commencing work.
- C. Material Safety Data Sheets (MSDS) of all chemical products required for the project shall be submitted for approval to the Hazard Communication Section at the Safety Division of PREPA. Once approved the Contractor shall keep a copy of the MSDS on the site.
- D. Contractor shall provide submittals for the products specified in each of the Technical Specifications.
- E. The Contractor shall provide any technical reference manuals or operational and maintenance information available for any equipment being installed.
- F. Contractor shall submit for evaluation a site specific Work Plan, including how to comply with the applicable environmental, safety, and health regulations. Before commencement of the work, the Contractor shall participate in a meeting with PREPA's Safety Officer and the Project Manager for a job briefing and a visit to the work area.

- G. Contractor shall submit results of all laboratory tests required.

1.4 RECORD DRAWINGS

- A. Contractor shall keep, at the site of work, a complete set of drawings for the purpose of noting thereon on a continuous basis, all field changes during construction. Changes will be marked in red.
- B. This set of provisional record drawings will be kept up to date with all changes noted thereon, and they shall be submitted for the inspection and approval of the Engineer, when requested.
- C. Upon termination of the installations, record drawings will be delivered through the Engineer to the Design and Drawing Department showing all as-built conditions before final closing of Contract.

1.5 GENERAL REQUIREMENTS

- A. It is the responsibility of the Contractor to coordinate with the Engineer the presence of any underground existing facilities, such as electrical conduits, cables, fuel lines, water lines, etc., which could be affected during construction.
- B. Contractor shall coordinate with the site's Operations Manager and with the Engineer the schedule for performing works as specified and required.
- C. Maintaining site operations is a priority for PREPA, so it shall be considered as an essential condition of this contract. As such, contract works cannot expose conflict with normal plant operations and is the responsibility of the Contractor to coordinate with the Engineer a work program that provides normal operation of the site during project progress.

The operational scheme for site operations relies solely on PREPA, so any order by PREPA to stop Contractor works or any delay related to PREPA granting availability of any area, equipment or material shall be considered as a foreseeable event.

- D. In the event contractor is unable to perform works due to any operational, maintenance, security or safety related determinations by PREPA, contractor's only remedy shall be an extension of time for performing his contract obligations.
- E. Contractor works to be performed close or adjacent to any facility or equipment in service shall be coordinated with the Engineer and the site's

Operations Manager. Full access to PREPA personnel to all areas in service or available for being in service shall be guaranteed at all times by contractor.

- F. Before start working the Contractor shall meet with designated health and safety personnel to establish specific safety and health precautions.
- G. It is the intention of these specifications and drawings to develop the work until the project is completed, that the necessary tests are done, and the system is left operational. The Contractor is responsible for any details that usually are not found in the drawings or specifications provided by PREPA, as there shall be a final design, certified issued for construction drawings under the full responsibility of the Contractor and approved by PREPA. Said details shall be included in the work, just as the ones specified and shown in the drawings.
- H. The Engineer can reject all materials and work done by the Contractor not according to the provided drawings, specifications, or contract. The Contractor will replace all the material and perform the necessary labor to correct the work or rejected material at his own cost, to the Engineer's satisfaction.
- I. If any errors or omissions occur, the Contractor shall notify the Engineer prior to submitting his proposal, so the necessary revisions or adjustments are made.
- J. It is the Contractor's responsibility to certify that documents submitted for approval does not deviate from the contract specifications. Any deviation or change not indicated in writing by the Contractor should automatically invalidate PREPA's seal of approval for that particular document.
- K. All work performed under these Specifications shall be done in a safe and workmanlike manner and in strict conformance with all local rules, regulations and ordinances, etc. The Contractor shall use all necessary safety equipment, such as reflective jackets, safety cones, and safety warnings at the work site near road areas and vehicle traffic.
- L. All proposals must be completed in the prescribed format for the purpose of basic comparison and evaluation. Additional or separate data, however, which each Bidder may wish to present for clarification or amendment, will be accepted without prejudice to the basic proposal, and will be considered in its applicable context.
- M. It shall be the Bidder's singular and sole responsibility to visit the jobsite and

to acquire whatever data is necessary for preparation of his/her proposal, to meet the obligations and warranties to the Authority, as detailed in these Specifications. This activity shall be accomplished at the Bidder's own initiative, time, and expense, and at no charge or expense to the Authority. Prior to submitting a proposal, the Contractor informs himself of all local conditions which might affect his performance of the work. Such conditions shall include, but are not limited to: site operation schemes and procedures, workmen's facilities, location of central points, access to the site, available utilities, and disposal areas of excavated materials, uncertainty of weather (including historic weather data), and all other contingencies.

1.6 TEMPORARY FACILITIES

A. Contractor's Field Office

- a) The Contractor's field office shall be of such construction as approved by the Engineer. A temporary telephone shall be installed and maintained during the extent of the construction time by the Contractor. The Authority shall issue orders and directions to the Contractor at this field office.
- b) The location of the construction offices and the preparation of the general area will be as specified by the Engineer.
- c) The Contractor shall maintain proper communication between his field office and his field personnel. Failure to maintain said communication shall be considered just cause to withhold any or all payments due to the Contractor until said communications are restored.

B. Light and Power

- a) The Contractor shall furnish and install immediately upon the start of the work and shall maintain for the duration of the construction period, adequate temporary light and electric power as required, for his own use and for the use of all trades, subcontractors, and separate contractors, in connection with the work. This installation shall be made in accordance with the National Electrical Code and as directed by the Engineer.
- b) The Contractor shall provide, at his expense, for all electric power consumed for the illumination, power testing of all equipment, and other fringe expenses and service charges.

C. Sanitary Conveniences

- a) The Contractor shall provide temporary sanitary conveniences for use of its employees and the employees of all trades, subcontractors, and separate contractors at the site, and maintain them in a sanitary condition until the completion of the work. Said facilities shall meet the approval of the Puerto Rico Board of Health.

D. Water

- a) The Contractor shall make the necessary arrangements and provide all water required during the entire construction period. The cost for temporary water shall be borne by the Contractor, except for that used in the hydrostatic test. Also, shall prevent the use of water for cleaning purposes. The use of dry cleaning techniques (absorbents wipe and vacuum) are necessary for the pollution potential of the NPDES discharges. This is a BMPP requirement.
- b) Under any circumstances the liquids will be discharged to the ground. This includes purge lines before any repair. There will not be any discharge of chemical products and hydrocarbons to the discharge system, not to cause any deviation to the NPDES permit.

E. Scaffolds, Staging, and Safety Devices

- a) The Contractor shall provide, erect, maintain, and remove when directed, all scaffolding, staging platforms, temporary turn ways, temporary flooring, guard railings, stairs, etc., as required by local and state codes, or laws, for the protection of workmen and the public.
- b) The construction, inspection, and maintenance of the above items shall comply with all safety codes and regulations, as applicable, to the project.

F. Access to Facilities

- a) Maintain at all times all access roads to the project reasonably free of accumulated mud and/or debris. Special note must be taken to the fact of little space availability. The Contractor shall note this and program his site activities accordingly. Additional space, if needed, will be provided by the Contractor at his cost in other facilities.

1.7 STANDARDS FOR EQUIPMENT AND MATERIALS

- A. All materials and equipment described or found necessary for the installation shall be new, free from defects, and shall be listed by Underwriters Laboratories, Inc. and by the American Water Works Association as conforming to their standards in every case where such standard has been established for the particular type of material in question. The Engineer shall approve all materials and equipment.
- B. Equipment and materials shall be properly stored, protected, and carefully handled, following the manufacturer's recommendations, to prevent damage before and during installation. Damaged or defective items shall be replaced at no cost to PREPA.
- C. Any equipment, material or work performed without the Engineer's approval or in disagreement with the drawings, specifications, or the contract, may be rejected. The Contractor shall replace, or repair rejected equipment or labor, at his expense as recommended by the Engineer.
- D. The Contractor shall furnish the services of an experienced licensed Engineer who shall constantly be in charge of the work together with skilled workmen, fitters, helpers, and labor required to properly unload, transfer, erect, connect, adjust, start, operate, and test the system. Work shall be performed in a workmanlike manner, shall present a neat and mechanical appearance when completed, and shall be subject to the approval of PREPA.
- E. Materials or equipment to be supplied by the Contractor shall be subject to the approval of the Engineer. Valves and piping shall be from U.S. Manufacturers.

1.8 PROGRESS REPORTS

- A. Contractor shall submit to the Engineer a monthly progress report with the following information:
 - a) Dates of completion for activities that have been completed since the last report.
 - b) Days remaining for in-progress activities.
 - c) Changes to reflect variations from or modifications to the original network plan.
 - d) Project progress evaluation with identification of problem areas.
 - e) Recent photographs showing the work in progress.

- B. At least once a month the PREPA will compare the progress information with the Master Schedule. He will present the results at a progress review meeting with the Contractor, with identification of problem areas, if any.
- C. Contractor shall submit to the Engineer his purchase order numbers, dates, description of the materials involved, and the delivery dates specified. Such information is to be submitted at monthly intervals so that the Engineer will be cognizant of the progress being made by the Contractor in the placing of orders.

1.9 TECHNICAL APPROACH

- A. The Contractor must provide a detailed technical approach to the Project including anticipated activity or methods of analysis and schedule. This section shall be organized to generally follow the arrangement of the items of work and the Scope of Engineering Services.
- B. The Contractor shall provide all shop drawings and documents typical of what will be furnished for this Project.
- C. Drawing submittals and specifications shall be provided in both reproducible hard copy on The Authority's standard drawing sheets and computer compatible media (AUTOCAD Version 2012 – Portable Hard Drive). All drawings shall be in English with dimensions in feet and inches.

D. Contractor:

Two (2) weeks after receiving purchase order.

- a) All physical outlines as required to show overall size and space requirements (including dismantling and maintenance) and the interrelationship of the various components.
- b) Cross sections and details required to satisfy the Authority that all components conform to specification requirements including design and physical arrangement.
- c) Equipment drawings showing weights and foundation details.
- d) Vendor catalog data, drawings, details, etc.
- e) All information required by Authority for design and location of all connecting Authority-furnished electrical items, such as cables,

conduits, etc.

- f) Bill of material
- g) Calculations and approval drawings.
- h) Installation, operating, testing, commissioning and maintenance instructions
- i) Spare parts and special tools listing

One (1) weeks after completion of each system.

- j) Record Prints
- E. The Project shall be conducted in two (2) phases. Phase I shall include conceptual engineering design and will be considered complete upon submittal of a final Conceptual Engineering Report (CER).
- F. Upon completion of the CER and approval by the Authority, the Contractor will perform detail design functions and prepare a Construction Installation Package (CIP) to implement the required design.
- G. Contractor's CIP plan shall allow for the appropriate sequencing to ensure maximum plant operation throughout the construction phase.
- H. Contractor shall have completed all engineering and design activities associated with implementing the systems established in the Phase I CER in Phase II. The task in Phase II shall be to implement the CIP to complete hardware fabrication, site construction and installation.
- I. Contractor shall coordinate final draft of CIP with the Authority's designated representative to correlate downtime for only critical phases of construction when absolutely necessary. The Contractor shall assure The Authority that all aspects of construction have been detailed and staged to be completed within the period allocated.
- J. The Contractor shall finalize and submit to the Authority a final CIP, including:
- a) Master construction schedule.
 - b) Final hardware fabrication schedule and a list of any factory tests required for the equipment.

- c) Four sets of drawing for approval.
- d) After approval of drawings, shall submit four final sets certified as Correct for Construction in concert with master construction schedule. Include a computer compatible media copy (AUTOCAD Version 2012 – Portable Hard Drive).
- e) Four sets of bills of materials showing part number on erection drawings.
- f) The Contractor shall allow the Authority 14 working days for the approval of drawings.
- g) Product data including rated capacities of selected models weights (shipping, installed, and operating), furnished specialties, and accessories.
- h) Wiring diagrams detailing field-installed wiring for controls.

1.10 Schedules indicating proposed methods and sequence of operations for selective excavation and demolition prior to commencement of Work. Include coordination for shut-off of utility services and details for dust and noise control.

1.11 FORCE ACCOUNT

If the Engineer and Contractor are unable to negotiate a price for any Changes and/or Extra Work in accordance with ARTICLE 10. Changes and/or Extra Work of the TERMS AND CONDITIONS, the Engineer may direct the Contractor to perform all or part of the revised Work on a force account basis. When the Engineer directs the Contractor to perform revised Work on a force account basis, PREPA will pay the Contractor as specified hereon:

A. Labor

PREPA will compensate the Contractor for labor at the actual rate of wage paid and shown on the payroll for every hour that the labor and foreman are actually engaged in the revised Work, plus an additional 15 percent for field and home office overhead costs and profit.

The foreman must be in direct charge of the specific operations and must be at the Project Site in order to be included in this compensation. Unless already included in the wage rates paid, the Contractor will also receive the actual labor-related costs incurred by reason of subsistence and travel

allowances, health and welfare benefits, pension fund, or other fringe benefits, provided those payments are required by collective bargaining agreement or other employment contract generally applicable to the classes of labor employed on the Work.

Contractor will prorate the wages of any foreman who is employed partly on the revised Work and partly on other Work. Contractor will determine the prorated wage based on the number of workers employed on each class of Work as shown by the payrolls. Contractor will prorate any subsistence or travel allowances paid to the foreman on the same basis as the prorated direct wages.

B. Materials

PREPA will pay the Contractor the actual cost of acceptable materials delivered and used in the revised work, including transportation charges paid by the Contractor (exclusive of equipment rentals), plus an additional 15 percent for field and home office overhead costs and profit.

C. Equipment

PREPA will pay the Contractor for Equipment at the rental rates agreed by both parties and effective on the date the two parties execute the force account agreement. This compensation is for equipment, fuel, and lubricants, transportation that the Engineer authorizes, and the Contractor uses on the Project, plus an additional 15 percent for field and home office overhead costs and profit. PREPA will not pay for small tools. PREPA will pay for the actual time the equipment is in operation on the revised Work, plus travel time or transportation allowances.

If the equipment is moved to and from the location of the revised work under its own power by PREPA's request, PREPA will pay for the travel time at the above rental rates.

1.12 DELIVERY, HANDLING AND STORAGE

- A. Products will be delivered to the project, properly identified with name, type, and other necessary information for its identification.
- B. Contractor will be responsible for the delivery, unloading, storage and handling of the materials or equipment to be used in the project, and maintain them in optimal conditions.
- C. Materials will be stored in an adequate area that satisfies the Engineer. The

storage area will remain clean, in optimal conditions, and free of hazards.

- D. Contractor will coordinate site storage and rubbish disposal areas with the Engineer.
- E. Equipment will be packed in suitable crates and boxes. Straps will be provided for full protection of equipment from damage during transit.
- F. Protect stored pipes, fittings, flanges, and valves from moisture and dirt by covering with durable, waterproofing tarpaulins if necessary.

1.13 SAFETY PROVISIONS

- A. The Contractor shall comply with the following minimum requirements of a health and safety program:
 - a) The plan shall have its own loss control program.
 - b) It shall include an accident or incident investigation procedure.
 - c) It will describe procedures for compliance with requirements of all applicable regulations included in the 29 CFR. The Program latest revision date shall not be greater than a year from the project's commencement date.
- B. The PREPA's auditing committee shall approve the program, as a requirement to be included in the Evaluated Suppliers Registry.
- C. Plan shall include the following:
 - a) Plan shall include contingency procedures that include how to proceed in an emergency situation, during an accident, in case of an atmospheric disturbance, fire, and spill.
 - b) Copy of all training certificates, licenses or certifications required, according to the scope of work. For example: pesticide applicator, electrician, spill responder, refrigeration technician, DOT training for hazardous substances, etc.
 - c) Copy of the Safety Data Sheets (SDS) of all chemical products to be used during the project, for evaluation and approval by the Occupational Safety and Health Office at PREPA (Hazard Communication Section). All chemical products must be approved by PREPA.

- D. Services including the application of chemical products within closed spaces, like buildings, will be offered between Monday and Saturday AFTER PREPA's WORKING HOURS. The Contractor will take all steps necessary to assure the area will be free of nuisance odors or vapors before PREPA personnel is to reoccupy. All these will be done in coordination with the local supervisor of PREPA. Services in exterior parts of PREPA can be done during regular working hours.
- E. The Contractor shall assure that all wastes are removed and properly disposed of, in accordance with all applicable laws and regulations, after completion of work. Any remaining construction material shall be removed from PREPA's facilities within 24 hours. If the Contractor is not able to dispose the materials, it shall be moved to an area protected from the elements.
- F. Before commencement of work, the Contractor shall take part in a coordination meeting with a Safety Officer, an Environmental Control Supervisor, and the project manager on PREPA's behalf. During this meeting the site-specific work plan will be discussed and reviewed, including the safety rules and the environmental protection procedures to be followed. Also, a tour of the areas to be worked on will take place.
- G. All chemical products to be used shall be classified as Approved or Conditionally Approved by PREPA's Substances and Waste Management Department and Hazard Communication Section.
- H. Welding operations will comply with the requirements of OSHA, ANSI, and NFPA.
- I. If the project involves the handling of non-asbestos insulation or other dust generating materials, like gypsum board, steps shall be taken to prevent the release of the dust to adjacent areas.
- J. The Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury, or loss to, all employees on the work and all other persons who may be affected. Also to the work, property, material and equipment on or off the site, under the care, custody or control of the Contractor or any of his subcontractors.
- K. The Contractor shall comply with all applicable laws, ordinances, rules, regulations, and lawful orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury, or loss. Shall erect and maintain, as required by existing conditions and

progress of the work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.

- L. The Contractor shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents, who shall develop and coordinate with the Safety Officer a safety program. He also has the responsibility of conduct and take record of the weekly security meetings with the Contractor's employees involved in the required works and to report all accidents or incidents occurred during the project duration.
- M. Compliance with all safety provisions by subcontractors shall be the responsibility of the Contractor.
- N. Contractor agrees that it shall perform all work in compliance with federal, state and local occupational safety and health regulations, including but not limited to, hazard communication, and right-to-know laws. In addition, the Contractor agrees to observe the compliance of all precautions stated upon the applicable materials safety data sheets and container labels of all chemicals used in the contracted work.
- O. Contractor will obtain and maintain, during the duration of the contract, the proper permits from all federal, state and local regulatory authorities or other applicable government agency with respect to discharge, disposal, use, storage, handling and transportation of hazardous chemicals and substances as and when applicable law or regulation requires. For projects including the handling of asbestos, lead, or spilled hazardous substances, the notification to EPA or the EQB will be done by the Contractor, but in coordination with the following PREPA personnel: Safety Officer, Environmental Control Supervisor, and the Substance and Waste Management Department.
- P. Contractor will not cause or permit any hazardous chemical or product containing a hazardous chemical to be at, or in the vicinity of, any place where any employee, agent, or contractor of Puerto Rico Electric Power Authority, or any employee of any such agent or Contractor, may be at risk or exposed to hazard as a result thereof during normal use or any foreseeable emergency.
- Q. Contractor will defend, indemnify, and hold harmless, the Puerto Rico Electric Power Authority, its employees, agents or assigns for any and all direct liabilities and expenses arising out of noncompliance with safety provision clauses, irrespective of any other terms of this agreement.
- R. The Puerto Rico Electric Power Authority may unilaterally terminate this

contract upon Contractor's nonobservance of any of the foregoing or for any failure to comply with any of the safety provisions on this Contract upon thirty (30) days of a written notice to Contractor.

1.14 ENVIRONMENTAL PROTECTION CONDITIONS

- A. The Contractor shall exercise every reasonable precaution throughout the life of the project to prevent silting of rivers, streams, sea, ocean, lakes, and reservoirs. Construction of drainage facilities as well as performance of other contract work, which will contribute to the control of settlements, shall be carried out in conjunction with earthwork operations or as soon thereafter as is practicable.
- B. Unless otherwise approved in writing by the Engineer, construction operations in rivers, streams, lakes, and reservoirs shall be restricted to those areas where channel changes are shown on the plans and to those areas that must be entered for the construction of temporary or permanent structures. Rivers, streams, lakes, and reservoirs shall be promptly cleared of all false work, piling, debris, or other obstructions placed therein or caused by the construction operations. Frequent fording or live streams with construction equipment will not be permitted. Temporary bridges or other structures shall be used wherever an appreciable number of stream crossings are necessary.
- C. Unless otherwise approved in writing by the Engineer, mechanized equipment shall not be operated in live streams except as may be required to construct channel and temporary or permanent structures. The Contractor shall exercise every reasonable precaution throughout the life of the project to prevent pollution of rivers, sea or ocean streams, lakes, or reservoirs.
- D. Pollutants, such as chemicals, fuels, lubricants, bitumen, raw, sewage and other harmful waste shall not be discharged into or alongside of rivers, streams, seas, oceans, lakes, or reservoirs or into natural or manmade channels leading thereto. The Contractor shall also comply with the applicable regulations relating to the prevention and abatement of water, air, and noise pollution among others. The Contractor shall be liable for any fines imposed to PREPA due to the Contractor's noncompliance with any federal or local environmental regulation.
- E. The Contractor agrees to indemnify PREPA for all direct liabilities and expenses arising out of any claim due to an environmental violation, caused by his enterprises during the performance of the contract or by nonperformance of its obligations under the contract.
- F. The Contractor should have available, close to the working area, the

necessary equipment to control and pick up any spilling that could occur, during the performance of the work required by the contract. The equipment should include the necessary for the waste disposal.

- G. All equipment to be used in the work area should be free of oil, transmission fluid or hydraulic fluid leakage. If the equipment develops a leakage during the work process, it should be repaired out of the PREPA site or replace immediately.
- H. The Contractor should dispose of all garbage generated because of this work, according to the environmental regulations. The use of PREPA's garbage disposal equipment is not permitted. The removed materials shall be disposed as soon as possible (less than 24 hrs.) in order to avoid exposed materials at open areas. If the materials cannot be disposed immediately, the Contractor shall move the materials to a contained and non-exposure area.
- I. Any Chemical product to be used shall be classified Approved by PREPA's Hazard Communications Section before entering the work area of PREPA's premises.
- J. The Contractor shall protect all chemical products to be used against rain or any other weather conditions. Prior to the use of any chemical product, the United States Environmental Protection Agency (USEPA), has to approve the discharge of any toxic substance under the NPDES Permit for each facility. Discharge of any product under the Federal Insecticide, fungicide and Rodenticide Act is prohibited unless specifically authorized under the NPDES Permit. The assistance includes, and is not limited to, any information regarding the process, products, and technical issues under EPA's evaluation.
- K. The Contractor shall avoid contaminating air, soil or water with chemical substances or waste material generated because of his work.
- L. As a part of best management practice, the Contractor shall avoid the use of water for cleaning purposes. The use of dry cleaning techniques (absorbents or vacuum cleaning) is necessary to avoid the potential contamination of the NPDES discharges. Also follow the section 12.0 of the Storm Water Pollution Prevention plan (SWPPP) for Palo Seco Steam Plant. The SWPPP is a requirement of NPDES permit.
- M. All chemical analysis shall be performed by a laboratory included in PREPA's Material Management Division Supplier's Register as companies properly qualified and evaluated by PREPA's Quality Assurance Department to

perform this type of work. PREPA's personnel will audit the sampling and disposal of waste material.

- N. The disposal of hazardous waste material (if any) shall be done in a PREPA-approved Treatment, Storage, Disposal Facility (TSDF).
- O. The Contractor shall comply with all environmental laws and regulations related to water, soil, and air quality.
- P. The Contractor shall comply with all arrangements established in the Consent Decree between PREPA and Environmental Protection Agency.
- Q. All work shall be performed according to the Storm Water Pollution Prevention plan (SWPPP) for Palo Seco Steam Plant, which is part of the Special Conditions of the NPDES permit.
- R. The Contractor will be held responsible for any NPDES violations and its related costs if the violations are related to the Contractor's activities.
- S. The Contractor shall submit evidence of compliance with 49 CFR 172 Subpart H (DOT).
- T. All work shall be performed according to Section 13 of the Storm Water Pollution Prevention Plan (SWPPP) for Palo Seco Steam Plant. (Section 13.0 – Contractor Practices and Procedures), included as follows:
 - a) Contractors are potential sources of contamination in storm-water and process wastewater because of the wide variety of materials used and the non-routine nature of their work. However, contractors must adhere to the PREPA policies regarding maintenance practices, operations practice, good housekeeping, training, materials compatibility, condition of equipment, and materials handling.
 - b) A routine part of a Contractor's is SWPP training. Each Contractor must confirm that its employees are properly trained in environmental and safety principles and pertinent plant policies. Nonadherence to these policies can result in dismissal of a Contractors employee or the entire Contractor Company.
 - c) Specific controls on Contractor activities include:
 - SWPPP training at Contractor orientation.
 - Documentation of materials brought on site by the Contractor.

Contractor must identify materials and amounts in their working plans. Also, Contractor must remove all unused material from the site at the completion of the project.

- Contractor's equipment must be in good working order. Equipment with broken or defective parts or oil leaks will not be allowed on site.
- U. It is necessary to avoid the development of a new storm-water discharge point as a consequence of the construction activities. These activities shall not cause any violations to the NPDES Permit Discharges.
- V. The Contractor shall submit, for evaluation by the Environmental Control Supervisor, a copy of a Site Specific Work Plan. The Plan shall include any other regulation or guideline applicable to the scope of work, and shall include a contingency plan which includes how to proceed in an emergency situation, such as: an accident, an atmospheric disturbance, hazardous chemical substance spill, a fire and others.
- W. The Contractor shall inform and coordinate with the Environmental Control Supervisor of any work to be done to avoid any environmental violation.
- X. Before starting the work, the Contractor shall submit, for evaluation by the Environmental Protection and Quality Assurance Division, a copy of a Site Specific Work Plan.
- Y. The Contractor, upon completion of the work, must leave all work areas clean, organized, and free of contaminants, according to the laboratory analysis, before and after the work. The storage area for the removed equipments and parts must be appropriate to avoid contaminants dispersion to the ground or water.
- Z. Temporary areas of construction and disposal materials shall be areas protected with dikes. In the absence of dikes, the Contractor shall prepare temporary areas with dikes to avoid materials exposure.
- AA. When using portalettes, the Contractor is responsible for the location of these in diked protected areas to prevent and avoid any sanitary discharge thru the power plant premises. It is prohibited to clean or wash the portalettes within the power plant premises.

PART 2 PRODUCTS

- A. All products in this project shall be approved by PREPA prior entrance to the property.
- B. Whenever in this specifications and technical specifications there are listed specific brands and models of products, it will be understood as equal or approved equal to said products. A 5-day period after the order to proceed will be allowed for the Contractor to submit alternate products, beyond this period the contractor shall provide the approved models.
- C. All equipment and materials shall be manufactured in one or more of the following listed countries:

USA	Italy	Japan
Canada	Belgium	Norway
Germany	Netherland	Poland
United Kingdom	Sweden	Portugal
France	Switzerland	Romania
Austria	Hungary	Spain
Bulgaria	Iceland	Finland
Czech Republic	Ireland	South Korea

PART 3 EXECUTION

3.1 REQUIRED WORK

- A. The required works will be based on the global cost of the project. These will be coordinated and integrated to obtain a uniform job stream. Contractor shall provide all ecatwalkengineering, permits, design, labor, equipment, materials and supervision required to successfully build one (1) New Condensate Water Tank 1-2 at Palo Seco Power Plant. The tank shall have a nominal capacity of 172,730 gallons with 35'-0" diameter and 24'-0" high dimensions, shall be vertical type with flat bottom and self-supported umbrella roof in accordance with this document and Technical Specifications. The project shall be completed in one hundred twenty (120) calendar days.

3.2 PERMITTING PROCESS

- A. Contractor shall perform all tasks, documentation requirements, and pay all fees regarding the approval of the OGPe's "Permiso Único Incidental Operacional (Permiso General Consolidado)". Contractor shall continue with the project works during the process of obtaining the "Permiso Único Incidental Operacional/(PUI) (Permiso General Consolidado/(PGC)".

- a) Contractor shall obtain and pay for the services for the inspection and certification for the following permit requirements:
 - i. PGC 009 – “Certificación de No Presencia de Asbesto en Estructuras a Demolerse”
 - ii. PGC 010 – “Certificación de No Presencia de Pintura con Base de Plomo en Estructuras a Demolerse”
- B. Contractor shall be responsible of executing and managing the “Plan CES” for the project.
- C. The Environmental Document (“Exclusión Categórica”) shall be PREPA’s responsibility.
- D. Contractor shall be responsible to deposit all scrap metal to a designated recycle dumpster designated by PREPA. Contractor will not be responsible for the disposal of such scrap metal.
- E. Contractor shall be responsible for the disposal of concrete debris, resulting from the expansion work of the existing concrete base.
- F. The “Plan CES” drawing shall be provided by the Contractor.
- G. Contractor shall obtain and pay for the removal lead permit from OGPe.

3.3 EXISTING TANK DEMOLITION

- A. Contractor shall be responsible for the complete demolition of the existing tank (D=35 ft. H=24 ft.).
- B. PREPA will provide a recycle dumpster for the steel scrap, including with lead paint.
- C. Roof, shell, bottom and structural members scrap metal shall be cut to pieces with a dimension equal or less to 5 ft. x 4 ft. for their handling.
- D. Contractor shall be responsible to deposit all scrap metal to the recycle dumpster. The dumpster will be place in coordination with the Contractor.
- E. Lead content over the 1.0 mg/cm² limit was found in the stairway, roof and shells. Refer to Annex ____ - Lead Sampling Report.
- F. Contractor shall be responsible for the disposition of concrete debris resulting

from the project.

- G. It is expected that a 6-8 inches sand bed lies between the tank bottom and the concrete base. Contractor shall presume that the sand is impregnated with some corrosion inhibitor oil. Contractor shall be responsible for the removal and disposition of this sand bed.



Existing Tank Roof Support Structure

3.4 SOIL AND TANK CONCRETE BASE EVALUATION

- A. PREPA will provide the following data:
- a) Soil Bearing Capacity.
 - b) Site Seismic Classification

- B. Contractor shall perform the analysis of the existing base and design any required modifications to comply with the new tank loads based on the latest API-650 and ASCE 7-16 codes revision.
- C. Contractor shall rectify the base level as per code requirement.
- D. Contractor shall replace the volume left by the removed sand bed with a reinforced concrete system:
 - a) Existing concrete shall be cleaned to remove residues of contaminants.
 - b) Concrete shall be treated with a two component, 100% solids, moisture tolerant, structural epoxy adhesive (grouting adhesive). Approved model: *Sikadur-32 Hi-Mod LPL* by Sika.
 - c) A ½" thick x 3" wide fiber joint shall be installed around all the base internal shoulder. Approved model: *Fibre Expansion Joint (D.S. NO. 320-F)* by W.R. Meadows-Seal Tight.
 - d) Steel reinforcement shall be (as minimum) fabricated using #3 steel rebar with 12" spacing in both directions.
 - e) Concrete mix with 5,000 psi @ 28 day, 24" slump, ½" basalt (blue) stone, 2 lb/yd³ fiber shall be design for the application.
- E. PREPA will establish an allowance of one hundred thousand dollars (\$100,000.00) for tank base modifications (which are not defined in this specifications) if deem necessary. This allowance will only be activated if the existing concrete base requires structural reinforcement or expansion.

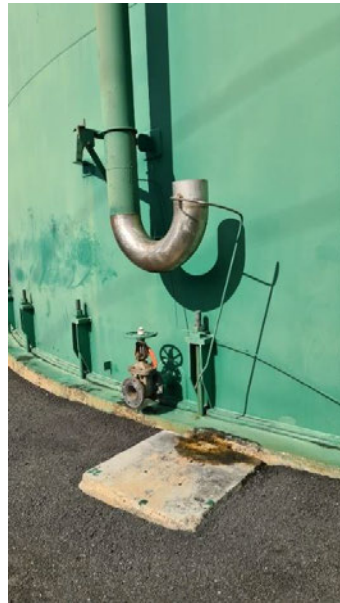
3.5 NEW TANK DESIGN AND FABRICATION

- A. Tank dimensions shall be D=35 ft. H=24 ft. with a nominal capacity of 172,730 gallons.
- B. Contractor shall implement the latest edition of API-650 code for the tank design.
- C. Design shall be performed and stamped by a Professional Engineer.
- D. Corrosion allowance shall be 1/16".
- E. Anchors design calculation shall be performed in accordance to API-650

- latest edition and using a Seismic Use Group III (SUG III), Importance factor (I) of 1.5.
- F. Anchors and anchor chairs installation.
 - G. Design temperature shall be 85 °F. (If this temperature is use, the tank cannot be use for condensate in the future).
 - H. Fluid shall be considered with a pH range of 5.5 to 8.5.
 - I. Steel grade shall be ASTM A36.
 - J. Spiral type stairway shall be 36" wide with a 10' x 6' top platform.
 - K. Every attachment or support connected to the tank shell shall be dressed with a reinforcing plate.
 - L. Wind velocities for the design shall be in accordance with the Puerto Rico Building Code specific for the site (maps), but never less than 179 mph for ultimate.
 - M. A full time Safety Officer shall be required at the site throughout the project duration. The Safety Officer shall be the person designated by the Contractor whose duty shall be the prevention of accidents and implement, both, the Safety and Health Program and the Site Specific Work Plan. The Safety Officer may be the contractor's project superintendent or supervisor and shall have successfully completed the thirty (30) hours Occupational Safety and Health Administration course in occupational safety and health standards for the construction industry.
 - N. Contractor shall follow API-650 (and reference codes) for the tank, ASME B31.3 for piping, AISC for pipe supports structural steel and IBC for foundations.
 - O. New illumination system including wiring, conduit, poles and luminaires.
 - a) Conduits shall be aluminum (or galvanized steel) with PVC coating. Approved model Plasti-Bond REDH2OT.
 - b) Pole shall be hot dipped galvanized.
 - c) Luminaries (3) shall be high power LED explosion proof for pole mounted application. All luminaries shall have an output of 16,000 lumens. Product shall be certified and wear IP66, Ex, ATEX, RoHS and CE markings. Applicable for gas explosion zone 1, zone 2 and zone 21,

zone 22 dust explosion. Rated frequency of 60 Hz and input voltage 90-305 VAC. Approved model Tormin BC9700-L150.

- P. Contractor shall provide tank grounding as per Annex 2 - Tank Grounding. The tank grounding shall be connected to the existing Power Plant Grounding Mat.
- Q. Bottom plates undersides shall be treated with Surface Preparation #2 (near white SSPC-SP10) and Coating System #9 as per Technical Specification 09900.
- R. Tank overflow shall be located at the maximum height permitted by code.
- S. One (1) 6" \varnothing (minimum) overflow pipe shall be included, fabricated with stainless steel schedule 10S and shall be fitted with a water seal formed with a candy cane shape (2-90° elbows) at the bottom position.



Arrangement Example

- T. One (1) 24" \varnothing roof manhole shall be included.
- U. Two (2) 2" \varnothing roof flanged nozzles shall be installed at the north location for recirculation and return demi water piping. The nozzles pipe shall extend 2 ft. inside the tank. The piping shell supports shall be installed with reinforcing (bearing) plates between the tank shell plates and the supports. One nozzle shall be connected to the Demi Water Pumps recirculation line using valve V-

34 (supplied by PREPA) and the other to the New Combustion Turbines demi water return line using valve V-35 (supplied by PREPA).

- V. One (1) 4" Ø roof flange nozzle (radar level gauge).
- W. Contractor shall include a non-contacting radar for tank liquid level measurement. The signal output shall be 4-20 mA with digital signal base on HART protocol. Housing material shall be aluminum, ½"-14 NPT conduit connection, stainless steel 316L cone antenna with PTFE seal, 4" Ø stainless steel raised face flange (ASME B16.5 Class 150) process connection, calibration data certificate, instrument accuracy of +/- 0.08" and frequency modulated continuous wave measurement principle. Approved model: *Rosemount 5408 Level Transmitter*. Contractor shall include all configuration licensing. Contractor shall be responsible for the wiring of the equipment up to the tank base. Electrical/control conduits shall be aluminum (or galvanized steel) with PVC coating, approved model *Plasti-Bond REDH2OT*.
- X. One (1) 10" Ø (minimum) roof vent fitted with an air filter shall be installed. The filter shall be an element type. The filter housing shall have a 10" 150# ANSI flanged connection, stainless steel 304 safety screen, cap design cover, 5-10 microns low pressure drop filter element and 3,000 cfm capacity. Approved Manufacturer: Flow Ezy Filters

Housing Model Number: B10-0409-FF-100
Element Number: 321-3411K5

Data sheet attached.
- Y. Two (2) 30" Ø shell manholes shall be included.
- Z. One (1) 2" Ø low type reinforced flanged connection with isolation 150# gate valve and blind flange (future pressure sensor for tank water level). Valve material shall be suitable for demineralized water application (supplied by Contractor).
- AA. One (1) 6" Ø low type reinforced flanged connection with isolation 150# gate valve and blind flange (drain). Valve material shall be suitable for demineralized water application (supplied by Contractor).
- BB. One (1) 8" Ø low type reinforced flanged connection (Inlet). This nozzle shall be connected to the Demi Water Header #1 using valve V-31 (supplied by PRAPA).

- CC. One (1) 6" Ø low type reinforced flanged connection (Outlet). This nozzle shall be connected to the New Demi Water Transfer Pumps Suction Header using valve V-32 (supplied by PRAPA).
- DD. Contractor shall include an external liquid level indicator (float and tape type) with an integral electronic transmitter for tank level measuring. Approved model: Shand & Jurs Model 92302 with L & J Engineering MCG 2420 Transmitter with HART communication protocol and calibration display. Indicator board, target, float, brackets, anchor bar, sheave assembly housing and guide wire spring assembly shall be stainless steel 316. The shell supports shall be installed with reinforcing (bearing) plates between the tank shell plates and the supports. Contractor shall also be responsible to wire and configure the new tank level transmitter into the existing pumps PLC control unit. The new configuration shall include alarms and pumps shut down based on the tank level. Contractor shall coordinate with the original PLC control designer (Engineered Parts and Services, Vega Alta, P.R.).
- EE. Contractor shall follow the requirements of API-650, section 7.3.6 for hydrostatic testing.
- a) Water connection for the hydrostatic test will be approximately 100 ft. from the tank. Contractor shall presume a filling flow rate of 100 GPM. The availability will be 8 hr. per day (one shift only).
 - b) The discharge location for hydrostatic water will be approximately 100 ft. from the tank.
 - c) Contractor shall consider 7 labor days to perform water analysis and to drain the tank.
- FF. All scaffolding shall be inspected, certified, and tagged with the corresponding labels.
- GG. Grit blast media (Black Beauty®) used to remove the existing coating shall not be recycled for final surface profile preparation to avoid surface contamination. Recycle material shall be pass thru a screening device and heated to remove any humidity. The contractor shall be responsible to avoid this situation using its preferable method. In most cases the surface can be prepared as final with only one pass of grit blasting. PREPA does not require two separate grit blasting if surface conditions are met with one pass.
- HH. All coating products shall be applied using a single or plural component airless system. Brushes and rollers will ONLY be used for initial stripe coat of all seams and corners.

- II. Construction and consolidated permits will be required for this project.
- JJ. The Contractor shall be responsible for the removal and disposal of the sand or media used for the blasting of the tank's interior and exterior surfaces. This material (blasting media) must be Non-Hazardous.
- KK. The Contractor/Subcontractor must be certified on the use or application of the specified coating systems. The Contractor must present an original certification signed by the coating manufacturer or official local representative stating that the employees performing the mixing and application of the coating systems were formally instructed in such procedures, specifically in the product used. Local firms shall present a current letter of representation from the manufacturer.
- LL. Besides the coating work on the tank interior (bottom, shell and roof) and exterior (shell and roof), the Contractor shall paint up to the next flange face and all welded support structure. Tank nozzles interior shall be coated with the same coating interior system.
- MM. Stripe coat requirement for paint layers:
 - a) Interior surfaces – Only before primer coat
 - b) Exterior surfaces – Before each coat
- NN. Cleaning
 - a) Surfaces shall be tested for contaminants before any rehabilitation or surface preparation. Cleaning as described in the preceding item shall be repeated if contamination levels are founded to be greater than the followings:
 - i. Chlorides > 20 mg/m² (2 µg/cm²)
 - ii. Sulfates > 20 mg/m² (2.5 µg/cm²)
 - iii. Nitrates > 25 mg/m² (2.5 µg/cm²)
- OO. Final Surface Preparation for field applied system (Refer to Specification 09900)
 - a) Interior (field 100%) for Coating System 12 – Surface Preparation #1, white metal (SSPC-SP5).
 - b) Interior (shop applied and field remaining bare metal) for Coating System 13 – Surface Preparation #1, white metal (SSPC-SP5) to 100%

of bare steel plate surfaces.

- c) Interior (field applied over shop primer) for Coating System 13 – Surface Preparation #8, brush-off (SSPC-SP7 / NACE No. 4) to 100% of the tank internal surface.
- d) Exterior – Surface Preparation #2, near white (SSPC-SP10). Requires 100% tank encapsulation.

PP. Coating, Lining and Repair System (Refer to Specification 09900)

- a) Interior – Field Applied (100% Surface) - Coating System 12
- b) Interior – Field & Shop Applied (100% Surface) - Coating System 13

PREPA will require and enforce a rigorous quality control and quality assurance for this system. Contractor shall submit a certification from the coating manufacturer establishing that all necessary repairs to the primer coat were successfully completed after the tank fabrication. The base coat shall not be applied until PREPA formally received and approved such document. Shop primed plates (interior surfaces) shall be left bare around all their perimeter with a minimum 12" width band. Contractor shall repair all damages inflicted over the primer during transportation and fabrication including but not limited to scratches and weld spatter. After these repairs, Contractor shall prepare 100% of the internal surface with Surface Preparation #8, brush-off (SSPC-SP7 / NACE No. 4). Surface shall be tested for contaminants as established in this specification before coating application.

- c) Exterior (100% of Surfaces) - Coating System 1

QQ. Tank bottom to concrete base edge shall be sealed with *Sikaflex® -1a* polyurethane elastomeric sealant.

RR. Contractor shall prepare test coupons as part of the quality control program. These coupons shall be prepared during initial, intermediate, and final stages of the Work. PREPA will require 3 coupons for interior and 3 for exterior. Each coupon shall reflect all stages of the coating process. PREPA will use these coupons for pull-off (adhesion) testing. Coupons material shall be carbon steel with a 12" x 12" x 1/4" size. A PREPA's inspector shall witness test coupon preparation process.

SS. The ID Plate shall be smooth sating matte finish Aluminum 5052 or 6061, with 1/8" thickness and engraved lettering. Other acceptable material will be

Stainless Steel 304 or 316. Contractor shall integrate a proper barrier to avoid galvanic corrosion.

- TT. All interior surfaces (100%) shall be subject to a High Voltage Holiday Spark Test.
- UU. Contractor shall keep record of the following information (Contractor could use the provided drawings of the tank for this requirement):
- a) Coating production batches and the location where it was applied.
 - b) Name of the painter and personnel in charge of the mixing.
 - c) Date, weather conditions, and substrate conditions.
 - d) Surface profile.
 - e) Application Method.
 - f) Coating thickness (WFT & DFT)
- VV. Surface profile tests shall be performed with a digital gauge similar to Elcometer® 224.
- WW. Manual version of the PosiTest AT-M will be allowed for adhesion testing.
- XX. The Contractor is not required to have a NACE inspector on-site for the project duration. Nevertheless, a weekly report from a NACE inspector during surface preparation and coating application period shall be delivered to PREPA on every construction meeting with PREPA's project manager.
- YY. Contractor shall prepare and install an identification plate (24" x 24") with the following information:

DATE: CONTRACTOR: PREPA PO:

INTERIOR COATING:

SURFACE PREPARATION: PROFILE:

PRIMER:	THICKNESS (DFT):
BASE:	THICKNESS (DFT):
FINISH:	THICKNESS (DFT):

EXTERIOR COATING:

SURFACE PREPARATION:

PROFILE:

PRIMER:

THICKNESS (DFT):

BASE:

THICKNESS (DFT):

FINISH:

THICKNESS (DFT):

ZZ. Colors

a) Interior

- i. Primer: Gold (when applicable)
- ii. Base: Red
- iii. Finish: Gray

b) Exterior

- i. Primer: Green
- ii. Base: Aluminum Grey
- iii. Finish: White

AAA. Contractor shall follow Annex 1 for tank identification.

BBB. Contractor's Project Engineer (with the required certifications) could serve as safety officer if is present at all time. Otherwise, Project Engineer shall be available to visit the project site at any time during the project and shall visit and supervise the works at least three times a week (8 hrs each day). If a non -resident Project Engineer scheme will be used, then a separate fulltime Safety Officer shall be provided. Contractor shall assure the presence of a qualified person at the site throughout the project duration.

CCC. Bidders shall consider the application methods established in the specifications for their proposals.

DDD. The external visual inspection report is included as Annex #3.

EEE. Contractor shall be responsible for all permits.

New Condensate Water Tank 1-2
Palo Seco Steam Plant
Requisition _____

END OF SECTION 15010

Government of Puerto Rico

Puerto Rico Electric Power Authority



Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES
Submittal to COR3 and FEMA



***Boiler, Generator & Turbine Repairs,
Palo Seco Steam Plant – unit 3***

1/28/2022



Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes



Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	Palo Seco Steam Plant, unit 3 – Boiler, Generator & Turbine Repairs
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number (Formerly Project Worksheet)	136271 - MEPA078 PREPA Island Wide FAASt Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: <Name>

<Insert title here>

PREPA Project Sponsor: <Name >

<Insert title here>



Section 2. Facilities

2.1. Facilities List

Name	GPS Location
Palo Seco Steam Plant, unit 3	[REDACTED] [REDACTED]

Note: GPS coordinates are required for all facilities.

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

Due to a major outage, Palo Seco Steam Plant needs to perform inspections, repairs and/or replacements to the boiler, generator and turbine of unit 3.

Section 3. Scope of Work

3.1. Scope of Work Description

The scope of work for the Boiler, Generator & Turbine Repairs of Palo Seco Steam Plant unit 3 will consist of the following:

- A. Boiler: Inspection and repairs of Economizer elements and high pressure components such as water wall panels.



- B. Generator: Remove rotor from generator so that the stator coils can be inspected, and perform tests on both, the rotor and the stator. Inspection of the excitation system. Upgrade to the control system.
- C. Turbine: Inspection of the internal elements of the high, intermediate and low pressure turbine, including its valves. This will be done by opening the turbine to inspect and repair the rotor, diaphragms, seals, bearings, and the throttle, governor, interceptor and reheat valves.

3.2. Type of Project

Indicate whether the intended plan is a(n):

- 1. **Restoration to Codes/Standards:** Restores the facility(s) to pre-disaster function and to approved codes/standards
- 2. **Improved Project:** Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
 - a. Other improvements, not required by codes and standards
 - b. Changes in facility size, capacity, dimension, or footprint
- 3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate)

If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.

Restores to Codes/Standards

Note: If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.

3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?



4.1. Codes, Specifications, and Standards

Yes/No. If yes, describe how incorporated below.
<ul style="list-style-type: none"> • (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE) • (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE) • Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730-B2 - U.S. Department of Agriculture Rural Electric Service (RUS) • International Building Code (IBC) - International Code Council (ICC) • International Energy Conservation Code (IECC) - International Code Council (ICC) • International Existing Building Code (IEBC) - International Code Council (ICC) • National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers • National Electrical Code (NEC) - National Fire Protection Association (NFPA) • FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.
<ul style="list-style-type: none"> • 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA) • 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA) • ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE) • International Building Code (IBC) - International Code Council (ICC) • Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA) • Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA) • RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS) • Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.

Cost Type	Amount (\$M)
Boiler inspection and repairs	\$3,000,000.00
Generator inspection and repairs	\$3,000,000.00
Turbine inspection and repairs	\$9,000,000.00
Total Project Estimated Cost	\$15,000,000.00



Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: *If available, detailed engineering cost estimates will be included as an attachment.*

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

Program Manager's Printed Name

Date

Title

Signature

Section 9. PREPA Project Sponsor Comments

Comments
<Insert any comments here>

PREPA Project Sponsor's Printed Name

Date

Title

Signature



Section 10. Attachments

10.1. Project Detailed Cost Estimates

Please see attached the following:

- Scope of Work

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures



10.4. Other: (Please Describe)

N/A

Alcance de Trabajo

Caldera:

El alcance de trabajo en la caldera incluye el reemplazo de componentes de alta presión tales como paneles de paredes de agua.

Turbina:

El alcance de trabajo de la turbina incluye la inspección de los elementos internos de la turbina de alta, intermedia y baja presión incluyendo las válvulas de esta. La inspección consiste en abrir la turbina para la inspección y reparación del rotor, diafragmas, sellos, cojinetes y las válvulas *throttle, governor, intercepto y reheater*.

Generador:

Inspección y reparación del rotor y estator del generador. El trabajo consiste en remover el rotor del generador para poder inspeccionar las bobinas del estator y realizarle pruebas tanto al rotor como al estator. El alcance incluye inspección del sistema de excitación y un *upgrade* al sistema de control.

Main Power Transformer (MPT)

El transformador principal de salida de la unidad (MPT) tiene varios salideros de aceite. El trabajo consiste en reparar esos salideros y reemplazar los radiadores que estén averiados y estén contribuyendo a esos salideros. Adicional, se le realizará mantenimiento al transformador tales como reparación de su integridad, pruebas a las bobinas, acondicionamiento del aceite, etc.

AUTORIDAD ENERGÍA ELÉCTRICA
CENTRAL PALO SECO
SECCIÓN CONTROL DE COSTOS

REHABILITACION TURBINA UNIDAD 4 CPS
ESTIMADO - 105950

CONTRATOS		GASTO	
REHABILITACION TURBINA ALTA PRESIÓN U-4 CPS	74547	1,488,786.84	MD&A
INSTALACION ROTOR HP - TURBINA U-4	79940	3,238,508.29	MD&A
SERVICIO REMOCION DE PINTURA - DUSTLESS BLASTING	81021	31,595.00	ARG PRECISION
LIMPIEZA COOLERS DE HIDROGENO Y ACEITE LUBRICACION	81075	49,893.00	INDUCHEM
LLENADO TANQUE FM 200 - EXCITATRIZ U-4	83061	11,995.00	CEL FIRE EXTINGUISHERS
REPARACION MOOG SERVO VALVES	83256	8,788.00	PHOENIX INDUSTRIAL
ALQUILER "LOW BED"	76346	35,013.33	ALL CONTRACTORS
TOTAL CONTRATOS		4,864,579.46	

MATERIALES			
MATERIAL ALMACEN		54,356.64	ALMACEN 16
PARKER PRESSURE RELIEF VALVE	83429	11,748.00	INRUMEC
BREAKERS	84029	85,888.00	PRIME CONTROLS
TOTAL MATERIALES		151,992.64	

JORNALES LABOR			
	65-0018	33,295.01	DCPS
	63-0019	36,307.49	DCCS
	63-0022	36,060.50	DCCS
	62-0004	9,104.61	DCSJ
	62-0003	13,492.12	DCSJ
	62-0002	12,092.53	DCSJ
	62-0001	12,294.48	DCSJ
	63-0020	40,233.51	DCCS
	66-0006	48,471.88	DCAG
	63-0014	25,908.76	DCCS
	63-0015	18,051.37	DCCS
	63-0017	28,378.00	DCCS
	63-0018	36,860.77	DCCS
	66-0025	44,662.97	DCAG
	63-0047	4,497.38	DCCS
	63-0052	25,552.60	DCCS
	63-0049	22,313.69	DCCS
	63-0051	25,566.65	DCCS
	63-0048	9,513.96	DCCS
	63-0050	26,849.13	DCCS
	66-0026	60,373.66	DCAG
	66-0027	27,755.46	DCAG
	73-0009	3,159.00	CAMBALACHE
	63-0077	26,040.65	DCCS
	63-0076	35,309.61	DCCS
	63-0075	33,380.06	DCCS
	63-0074	40,793.31	DCCS
	62-0010	1,723.27	DCSJ
	62-0006	9,839.72	DCSJ
	62-007	12,109.74	DCSJ
	62-0008	10,851.97	DCSJ
	62-0009	4,340.03	DCSJ
TOTAL JORNALES		775,183.89	

TOTAL ESTIMADO 105950	5,791,755.99
OVERHEAD	<u>2,016,887.21</u>
TOTAL	<u><u>7,808,643.20</u></u>

AUTORIDAD ENERGÍA ELÉCTRICA
CENTRAL PALO SECO
SECCIÓN CONTROL DE COSTOS

REHABILITACION GENERADOR UNIDAD 4 CPS
ESTIMADO - 105948

CONTRATOS		GASTO	
INSPECCIÓN ROTOR GENERADOR	77714	259,025.00	MD&A
REBOBINADO ROTOR GENERADOR	80080	679,065.00	MD&A
REPARACION BLOWER DE HIDROGENO - GENERADOR U-4	76434	1,225,420.92	RG ENGINEERING
GENERADOR - "LOW BED"	76585	<u>14,950.00</u>	ALL CONTRACTORS
TOTAL ESTIMADO 105948		2,178,460.92	
OVERHEAD		<u>171,317.43</u>	
TOTAL		<u><u>2,349,778.35</u></u>	

AUTORIDAD ENERGÍA ELÉCTRICA
CENTRAL PAÑO SECO
SECCIÓN CONTROL DE COSTOS

REHABILITACION CALDERA UNIDAD 4 CPS
ESTIMADO - 106014

GASTO

CONTRATOS			
REPARACION VALVULAS DE SEGURIDAD	79586	48,000.00	ENGINEERING SYSTEMS SALES
INSPECCION Y REPARACION VALVULA ENTRADA ECONOMIZER	76861	14,685.00	ENGINEERING SYSTEMS SALES
REPARACION VALVULA BOILER LEAD	81739	37,445.00	ENGINEERING SYSTEMS SALES
PIPING SUPPORT SYSTEM	80499	187,000.00	ENERSYS ENGINEERING
INSPECCION Y REPARACION CHECK VALVE ECONOMIZER	81958	18,948.56	ENGINEERING SYSTEMS SALES
LIMPIEZA INDUSTRIAL MECANICA	79885	12,835.38	INDUCHEM
LAVADO INDUSTRIAL CON MAQUINA DE PRESION	79753	<u>15,259.13</u>	INDUCHEM
TOTAL CONTRATOS		334,173.07	

MATERIALES			
TWIN SOURCE TRANSFER SWITCH FOR BMS	77962	19,538.00	PHOENIX
PIPE GAL S40	80577	18,600.00	STEEL & PIPES
MATERIALES PARA CALDERA	82367	22,290.30	UNIVERSAL PIPES
MOTOR ELECTRICO DEL ACTUADOR VALVULA DESCARGA BFP	82869	7,612.00	CORTES
MATERIAL ALMACEN	65-0039	<u>784,871.56</u>	ALMACEN 16
TOTAL MATERIALES		852,911.86	

JORNALES LABOR	65-0063	276,916.22	DCPS
	66-0033	139,818.71	DCAG
	63-0014	425,738.29	DCCS
	65-0018	33,295.01	DCPS
	63-0047	4,497.38	DCCS
	63-0052	25,552.61	DCCS
	63-0049	22,313.68	DCCS
	63-0051	25,566.66	DCCS
	63-0048	9,513.96	DCCS
	63-0050	<u>26,849.13</u>	DCCS
TOTAL JORNALES		990,061.65	

TOTAL ESTIMADO 106014	2,177,146.58
OVERHEAD	<u>361,972.62</u>
TOTAL	<u><u>2,539,119.20</u></u>

Government of Puerto Rico

Puerto Rico Electric Power Authority



Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES
Submittal to COR3 and FEMA



***Unit 1 Rehabilitation,
Cambalache Power Plant***

1/27/2022



Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes



Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	Cambalache Power Plant - Unit 1 Rehabilitation
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number (Formerly Project Worksheet)	136271 - MEPA078 PREPA Island Wide FAASt Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: <Name>

<Insert title here>

PREPA Project Sponsor: <Name >

<Insert title here>



Section 2. Facilities

2.1. Facilities List

Name	GPS Location
Cambalache Power Plant, Unit 1	[REDACTED] [REDACTED]

Note: GPS coordinates are required for all facilities.

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

Cambalache Power Plant wants to rebuild its Unit 1, that has been disassembled since the forced outage on September 11, 2011. This unit returned to service after its mayor inspection during the summer of 2010. After 1,316 equivalent operating hours of operations, in September 2011 an unforeseen event took place during the start-up when the combustion chamber became flooded with an excessive amount of fuel. During the ignition sequence, the ignited fuel caused an explosion inside the Hot Gas Casing (HGC) and several components were damaged. The gas turbine was disassembled to assess the occurred damages. Several inspections have been carried out over the years with the purpose of returning the asset back to service. Since then, Unit 1 stayed in disassembled state.

The recovery project takes between 8 thru 12 months depending on the parts and the resources availability. The project will consist of the replacement of the turbo-compressor parts and HGP parts damaged during with the 2011 failure. In addition, as required, the controls systems and related components will be replaced or upgraded. A major overhaul will be performed in the unit generator. The project will be a complete recommission of the unit and its auxiliary equipment's.



With this unit recovered, the Plant will be restored to its design capacity of having three units, with the capacity of starting two at the same time, and with that, injecting to the grid 20 MW each in 15 minutes and 164 MW in approximately 1 hour. After this recovery project and major overhaul, the unit returns to a like new condition offering an increase in the Plant power generation of 82MW, a good available and know reliability gas turbine, and no environmental restrictions for a new source of emissions.

Section 3. Scope of Work

3.1. Scope of Work Description

The scope of work for the Cambalache Power Plant Unit 1 Rehabilitation will consist of the following:

- Contractor must provide the outage management, supervision, Hot Gas Path (HGP) and compressor parts, and all necessary equipment/components needed for rebuilding Unit 1:
 - GT11N1 Gas Turbine Rebuilding: • Pre-outage GT planning • Scheduling and project management • Mobilize to site all supervision personnel, tooling, and temporary equipment • Parts auditing/assessment • Organize special tooling • Prepare laydown • LOTO / Safety services • Clean bearings and take measurements & NDT • Ice blast turbine shell, clean and prepare for assembly • De-blade turbine rotor as required and Ice blast • Clean rotor and prepare for assembly • Install all compressor vanes • Install turbine blades • Disassemble Vane Carrier as needed, clean • Install Vane Row 1 • Clean and inspect compressor diffuser and assemble. • Disassemble Combustion Chamber and Replace necessary components, rebuild Fuel Oil Nozzle, Trip, Fill/Shut-off, Nozzle BOV, and leakage valves. • Clean and reassembly center burner and steam injection manifold • Inspect and Clean exhaust gas housing, intake plenum and paint, VIGV's, Blow Off Valves, cooling and sealing air piping. • Reinstall lower half internal components • Perform Turbine Rotor Lifetime Assessment • Install rotor • Blade and Vane tip grinding if necessary • Install internal components upper half • Install upper turbine casing • Perform assembly measurements as required • Install Combustor • Perform assembly measurements as required • Install BOV housing • Install Insulation • Install all removed piping • Install air intake and GT enclosure • Perform Alignment checks • Perform Motor Roll • Install Burner • Reconnect Piping • Install Thermal Blankets.
 - Generator: • Turbine Generator Stator (TGS) • Turbine Generator Rotor (TGR) • Turbine Generator Exciter (TGE).
 - Commissioning and Startup Support: • Cold commissioning • Hot Commissioning • Emissions and Pulsations Testing • GT/Generator Balancing • Base Load Adjustment.



3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards:** Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project:** Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
 - a. Other improvements, not required by codes and standards
 - b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate)
<i>If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.</i>
Restores to Codes/Standards

Note: If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.

3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?

4.1. Codes, Specifications, and Standards

**Yes/No. If yes, describe how incorporated below.**

- (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE)
- (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE)
- Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730B-2 - U.S. Department of Agriculture Rural Electric Service (RUS)
- International Building Code (IBC) - International Code Council (ICC)
- International Energy Conservation Code (IECC) - International Code Council (ICC)
- International Existing Building Code (IEBC) - International Code Council (ICC)
- National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers
- National Electrical Code (NEC) - National Fire Protection Association (NFPA)
- FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.

- 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA)
- 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA)
- ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE)
- International Building Code (IBC) - International Code Council (ICC)
- Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA)
- Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA)
- RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS)
- Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.

Cost Type	Amount (\$M)
Unit 1 Rehabilitation	\$18,000,000.00
Total Project Estimated Cost	\$18,000,000.00

Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.



6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: *If available, detailed engineering cost estimates will be included as an attachment.*

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

Program Manager's Printed Name

Date

Title

Signature

Section 9. PREPA Project Sponsor Comments

Comments
<Insert any comments here>

PREPA Project Sponsor's Printed Name

Date

Title

Signature



Section 10. Attachments

10.1. Project Detailed Cost Estimates

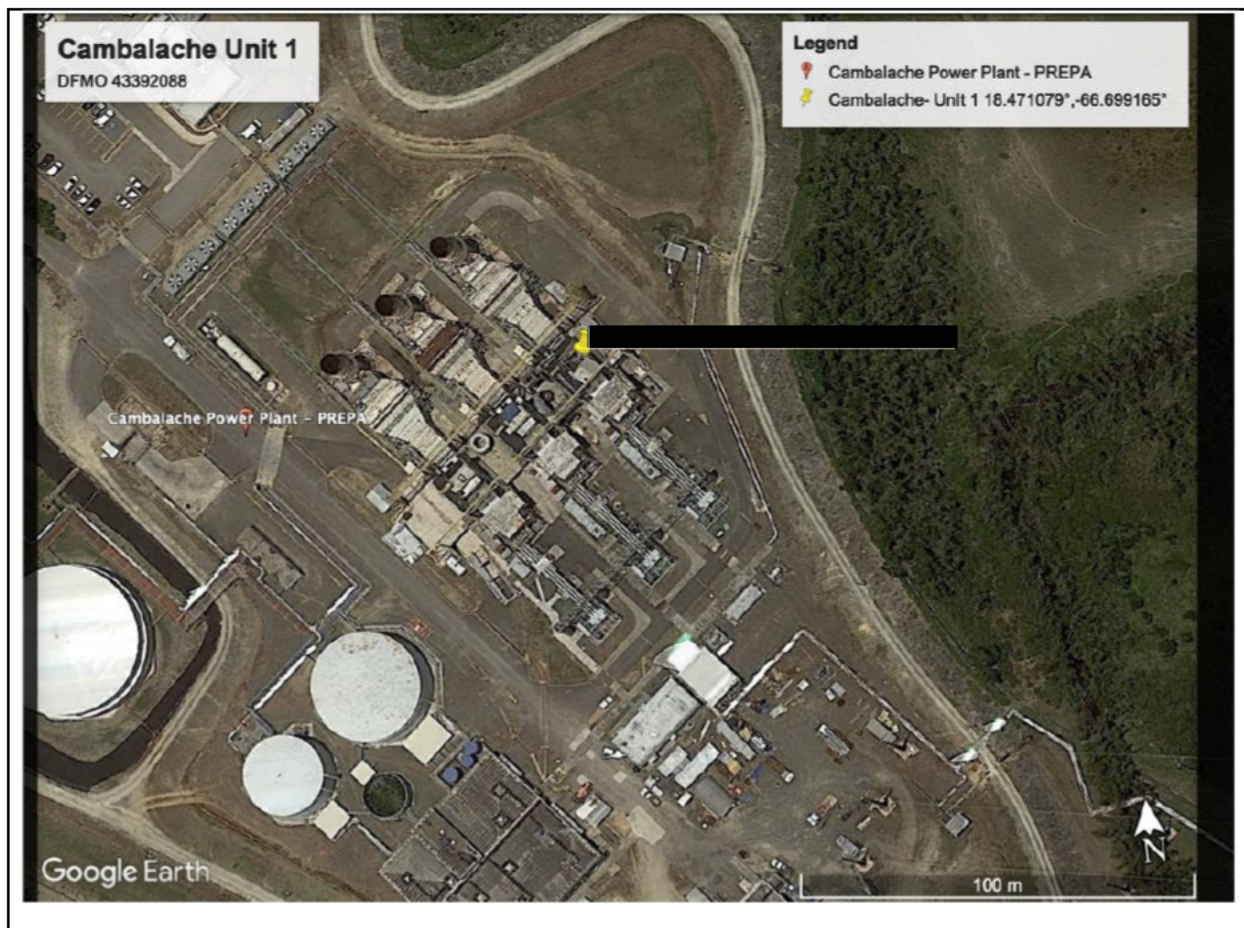
Please see attached the following:

- Justification, SOW and Cost Estimate_GT1 Rehabilitation

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures



10.4. Other: (Please Describe)

N/A

<u>Project Name:</u>	Unit 1 Rehabilitation
<u>Location:</u>	Cambalache Power Plant
<u>Asset:</u>	Cambalache GT1 – GT11N Combustion Turbine
<u>Estimated cost:</u>	\$ 18,000,000
<u>Asset Suite Data:</u>	Procurement process for: Unit 1 Rebuild after Forced Outage on September 11, 2011 has not been accomplished. This due to a couple of major factors: insufficient funds in the past 10-year's budget for major projects and PREPA's Top Management Decisions about the unit's future. The latest failed attempt to recover the unit was done in 2020 but the project was cancelled by PREPA's top Management..
<u>Historical Event:</u>	This unit returned to service after its mayor inspection during the summer of 2010. After 1,316 equivalent operating hours of operations, in September 2011 an unforeseen event took place during the start-up when the combustion chamber became flooded with an excessive amount of fuel. During the ignition sequence, the ignited fuel caused an explosion inside the Hot Gas Casing (HGC) and several components were damaged. The gas turbine was disassembled to assess the occurred damages. Several inspections have been carried out over the years with the purpose of returning the asset back to service. Since then Unit 1 stayed in disassembled state.
<u>Availability for Operation:</u>	The recovery project takes between 8 thru 12 months depending on the parts and resources availability. The project will consist of the replacement of the turbo-compressor parts and HGP parts damaged during with the 2011 failure. In addition, as required the controls systems and related components will be replaced or upgraded. A major overhaul will be performed in the unit generator. The project will be a complete recommission of the unit and its auxiliary equipment's.
<u>Project Benefits</u>	With this unit recovered the Plant will be restored to its design capacity of having three units with the capacity of starting two of the at the same time and with that injecting to the grid 20 MW each in 15 minutes and 164 Mw in approximately 1 hour. After this recovery project and major overhaul, the unit returns to a like new condition offering an increase in the Plant power generation of 82MW, a good available and know reliability gas turbine, and no environmental restrictions for a new source of emissions.
<u>General Description:</u>	The recovery project will consist of replacement necessary mechanical parts needed to return the Unit 1 back in service. Provide management, technical direction, specialized services, turbo-compressor and HGP parts, for the preparation and reassembly, commissioning and startup of the Unit 1. The scope of work will cover some components of GT turbo-compressor, vane carrier, combustor, thermal block, bearings and air intake system. Rebuild fuel valves, inspect, clean and test all auxiliary

equipment needed. Perform necessary electrical testing to the generator and stator including the brushless exciter.

Disposal: PREPA Cambalache will retain all removed equipment and material for proper disposal according to applicable regulations, except Hot Gas Path part, which will be retained by the contractor to be sent for refurbishing.

Technical Specification:

The contractor must provide the outage management, supervision, Hot Gas Path and compressor parts and all necessary equipment, components needed for rebuilding of the GT11N1 Unit 1 gas turbine at the Cambalache facility as described below.

GT11N1 Rebuilding Scope:

- Pre-outage GT planning
- Scheduling and project management
- Mobilize to site all supervision personnel, tooling, and temporary equipment.
- Parts auditing/assessment
- Organize special tooling
- Prepare laydown
- LOTO / Safety services
- Clean bearings and take measurements & NDT
- Ice blast turbine shell, clean and prepare for assembly
- De-blade turbine rotor as required and Ice blast
- Clean rotor and prepare for assembly
- Install all compressor vanes
- Install turbine blades
- Disassemble Vane Carrier as needed, clean
- Install Vane Row 1
- Clean and inspect compressor diffuser and assemble.
- Disassemble Combustion Chamber and Replace necessary components, rebuild Fuel Oil Nozzle, Trip, Fill/Shut-off, Nozzle BOV, and leakage valves.
- Clean and reassembly center burner and steam injection manifold

- Inspect and Clean exhaust gas housing, intake plenum and paint, VIGV's, Blow Off Valves, cooling and sealing air piping.
- Reinstall lower half internal components
- Perform Turbine Rotor Lifetime Assessment
- Install rotor
- Blade and Vane tip grinding if necessary
- Install internal components upper half
- Install upper turbine casing
- Perform assembly measurements as required
- Install Combustor
- Perform assembly measurements as required
- Install BOV housing
- Install Insulation
- Install all removed piping
- Install air intake and GT enclosure
- Perform Alignment checks
- Perform Motor Roll
- Install Burner
- Reconnect Piping
- Install Thermal Blankets

Generator:

Turbine Generator Stator (TGS)

Perform a visual and borescope inspection (as accessible).

- TGS Electrical Testing, including:
 - Copper Resistance Measurements,
 - Insulation Resistance Testing,
 - Polarization Index Testing,
 - RTD Resistance Measurement and RTD Insulation Resistance Testing.
 - Electro-magnetic Core Imperfection Detection (EICID).

- Wedge Tightness Detection (WTD).

Turbine Generator Rotor (TGR)

Perform a visual and borescope inspection (as accessible).

- TGR Electrical Testing, including:
 - Copper Resistance Measurement
 - Insulation Resistance Testing
 - Polarization Index Testing
 - AC Impedance Testing

Turbine Generator Exciter (TGE)

Perform a visual and borescope inspection (as accessible).

- TGE Electrical Testing, including:
 - Brushless Exciter Armature Insulation Resistance Testing
 - Brushless Exciter Stationary Field Insulation Resistance Testing.
- Reporting and documentation of inspection results and critical findings.

Commissioning and Startup Support

Cold commissioning

- Oversee instrument installation and Calibrate VIGV
- Set up logic and trip checks for all motor roll/start
- Check/Calibrate out group Valves
- Turning Gear (barring)

Hot Commissioning

- Motor roll
- Flame Off Tests / Min Flow Run
- Full Speed No Load, Real Overspeed Test
- Part load Mapping Gas

- Baseload Adjustment

Emissions and Pulsations Testing

- Review customer calibration documents
- Instrument installation and Calibration
- Calibration and reading verification at Full Speed No Load
- Part load Mapping Gas
- Baseload Adjustment

Equipment Required

- Data Acquisition Interface Laptop
- Emission Equipment
- Pulsation Equipment
- Calibration Gases (Customer Supplied)

GT / Generator Balancing

- Install Independent Sensing Instrumentation
- Set-Up Data Acquisition Interface Laptop

Base Load Adjustment

- Function Checks Fuel oil system
- Verify Compressor Discharge Pressure transmitters/cards
(MBA80CP011/MBA80CP012) are calibrated
- Verify TAT transmitters/cards for turbine exit temperature are calibrated
- Verify VIGV transmitters/cards are calibrated
- Installation/removal of independent sensing instrumentation & transmitters
- Set up/disassembly of data acquisition systems
- Preliminary fuel system analysis performed

- For Base Load Adjustment and E&P Measurements
- One electrical/I&C person to assist in the maintenance
- Preliminary fuel analysis made available
- Required plant dimensions made available (including but not limited to piping diameters/ orifice diameters/ etc.)
- Plant transmitter certification/calibration records made available as needed
- Calibration Gases

Offline Scope – Idle

- GT is inspected for air leaks, gas and fuel leaks, instrument readings correctness.

Online Scope - Unit operates at base load (VIGV at fully open, temperature control active, in emissions compliance) for at least three hours

- Testing measurements are taken for 1 consecutive hour with stable ambient conditions.
- Control formula is evaluated and modified as needed to reach optimal operation temperatures at base load on site.
- A field report summarizing commissioning activities shall be issued.

GT / COMPRESSOR PARTS

Due to the undetermined condition of Unit parts at this time, the contractor will replace all GT Hot Gas Path and Compressor internal mechanical parts (except Rotor), deemed not suitable for continued use, including Hot Gas Casing and a new set of Thermal Insulation Blankets.

Contractor can retain as its own property and at no cost all existing Unit 1 Hot Gas Path parts replaced as part of this rehabilitation project.

Manpower Provided

- One (1) Outage Manager
- One (1) Controls Upgrades Manager
- Two (2) Lead Technical Field Advisors
- One (1) Commissioning Engineer
- Two (2) Emissions & Pulsations Engineers
- One (1) Thermal Blankets Field Advisor
- Two (2) BlueLine/P400/GMS/SOD Engineers
- Two (2) SFC/AVR Engineers

- One (1) iFix HMI Engineer
- Two (2) Bladers
- One (1) Tool Room Attendant
- One (1) Runner

Schedule, Key Milestone Dates

The above mechanical SOW duration is expected to take One Hundred Twenty (120) days from start of mechanical work on site to reaching baseload, 12 hours per day using single shift. This estimate is subject to unit conditions at the time work begins and may vary.

Contractor will repair, remedy, any non-conforming work or parts provided in this project at no cost to PREPA for one (1) year from turnover of the unit or fourteen (14) months after the start of the rebuild outage, whichever comes first.

Government of Puerto Rico

Puerto Rico Electric Power Authority



Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES
Submittal to COR3 and FEMA



***Control System and Power Plant
Maintenance Consulting Services
For Cambalache Units 1 and 2***

1/28/2022



Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes
v.1	1/28/2022	



Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	Control System and Power Plant Maintenance Consulting Services for Cambalache Units 1 and 2
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number (Formerly Project Worksheet)	136271 - MEPA078 PREPA Island Wide FAASt Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: <Name>

<Insert title here>

PREPA Project Sponsor: <Name >

<Insert title here>



Section 2. Facilities

2.1. Facilities List

Name	GPS Location
<i>Cambalache Power Plant</i> Control System Power Plant Maintenance – Generator and Technical Services for Cambalache Units 1 and 2	<div></div> <div></div> <div></div> <div></div>

Note: GPS coordinates are required for all facilities.

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

Provide technical support and parts replacement for the generating unit control systems with Original Equipment Manufacturer trained technical advisors. The provided services will be a complete maintenance program for the continuous operations of the included equipment and its systems, especially for the obsolete equipment's. It will include parts replacement, software updates, backups, servers and network devices health issues solution and unexpected issues solutions. Provide 24-hour point of contact phone and email support and Gas Turbine Control, AVR, SFC and Vibro Smart System check and preventive maintenance.



Section 3. Scope of Work

3.1. Scope of Work Description

The scope of work for Cambalache Power Plant Control System Power Plant Maintenance Generator and Technical Services to provide technical support, troubleshooting, technical advisor and parts replacement will consist of the following:

HMI (Human Machine Interface) maintenance

- Provide software maintenance releases, service packs, patches and updates
- Version upgrades
- New developed training and maintenance software
- Install newest iFix and iHistorian SIMS (Software Improvement Modules)
- Network Switch upgrade
- Check Overall system health: hard drive space, hard drive partitioning.
- Check for correct communication between HMI stations and controllers.
- Perform SQL databases Maintenance: export and delete from live database out-of-date SOE entries (one new table per year will be created, and a new HMI screen will allow operation to access this table), perform SQL optimization.
- Perform screens and database modification/improvements as per PREPA Cambalache requests.
- Create HMI stations backup and images (one backup set for site, and one backup set for HTS).

Gas and Steam Turbine Control System– Yearly Check

- Check Overall system health
- Backup all Processor logic, card configuration
- Document all SME and Data alarms, explain and correct if required
 - Review all operator concerns and suggestions, make minor modifications as agreed, eliminate nuisance alarms and correct logic errors
 - Replace all faulty cards
 - Automatic Voltage Regulator – Yearly Preventive Maintenance
 - Check Overall system health
 - Cleaning of all components
 - Backup all Processor logic, card configuration



- Operation check, channel switchover
- Automatic Voltage Regulator – 2 Year Preventive Maintenance
- Check Overall system health
- Cleaning of all components
- Backup all Processor logic, card configuration
- Document all SME and Data alarms, explain and correct if required
- Check interface with plant control system
- Calibrate all Transducers
- Check all Protection
- Operation check, channel switchover

Static Frequency Convertor – Yearly Preventive Maintenance

- Check Overall system health
- Backup all Processor logic, card configuration
- Document all SME and Data alarms, explain and correct if required
- Check interface with plant control system
- Operation check and recording
- Static Frequency Convertor – 2 Year Preventive Maintenance
- Check Overall system health
- Backup all Processor logic, card configuration
- Document all SME and Data alarms, explain and correct if required
- Check interface with plant control system
- Clean all components
- Check of all protection
- Thyristor health check
- Operation check and recording

VibroSmart Pulsation System – Yearly Preventive Maintenance

- Check Overall system health on HMI.
 - Verify pulsation chains are fully connected.
-



- Backup all VibroSmart configuration files from Server to external disk.
- Basic operation check: Channel switchover from primary to backup system.

VibroSmart Pulsation System – 2 Year Preventive Maintenance

- Check Overall system health on HMI.
- Verify pulsation chains are fully connected.
- Backup all VibroSmart configuration files from Server to external disk.
- Document all VibroSmart/Pulsation alarms, explain and correct if required.
- Perform a pulsation chain check to verify there is no electronic component degradation. If there is, then replace the faulty component.
- Complete operation and protection check: Check interface with plant control system with complete operation and protection test that was performed at time of installation.

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards:** Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project:** Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
 - a. Other improvements, not required by codes and standards
 - b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate)

If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.

Restores to Codes/Standards

Note: If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.



3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?

4.1. Codes, Specifications, and Standards

Yes/No. If yes, describe how incorporated below.

- (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE)
- (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE)
- Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730-B2 - U.S. Department of Agriculture Rural Electric Service (RUS)
- International Building Code (IBC) - International Code Council (ICC)
- International Energy Conservation Code (IECC) - International Code Council (ICC)
- International Existing Building Code (IEBC) - International Code Council (ICC)
- National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers
- National Electrical Code (NEC) - National Fire Protection Association (NFPA)
- FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.

- 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA)
- 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA)
- ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE)
- International Building Code (IBC) - International Code Council (ICC)
- Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA)
- Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA)
- RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS)
- Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)



Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.

Cost Type	Amount (\$M)
Maintenance	\$2,500,000.00
Total Project Estimated Cost	\$2,500,000.00

Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: If available, detailed engineering cost estimates will be included as an attachment.

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

Program Manager's Printed Name

Date

Title

Signature

Section 9. PREPA Project Sponsor Comments

Comments



<Insert any comments here>

PREPA Project Sponsor's Printed Name

Date

Title

Signature

Section 10. Attachments

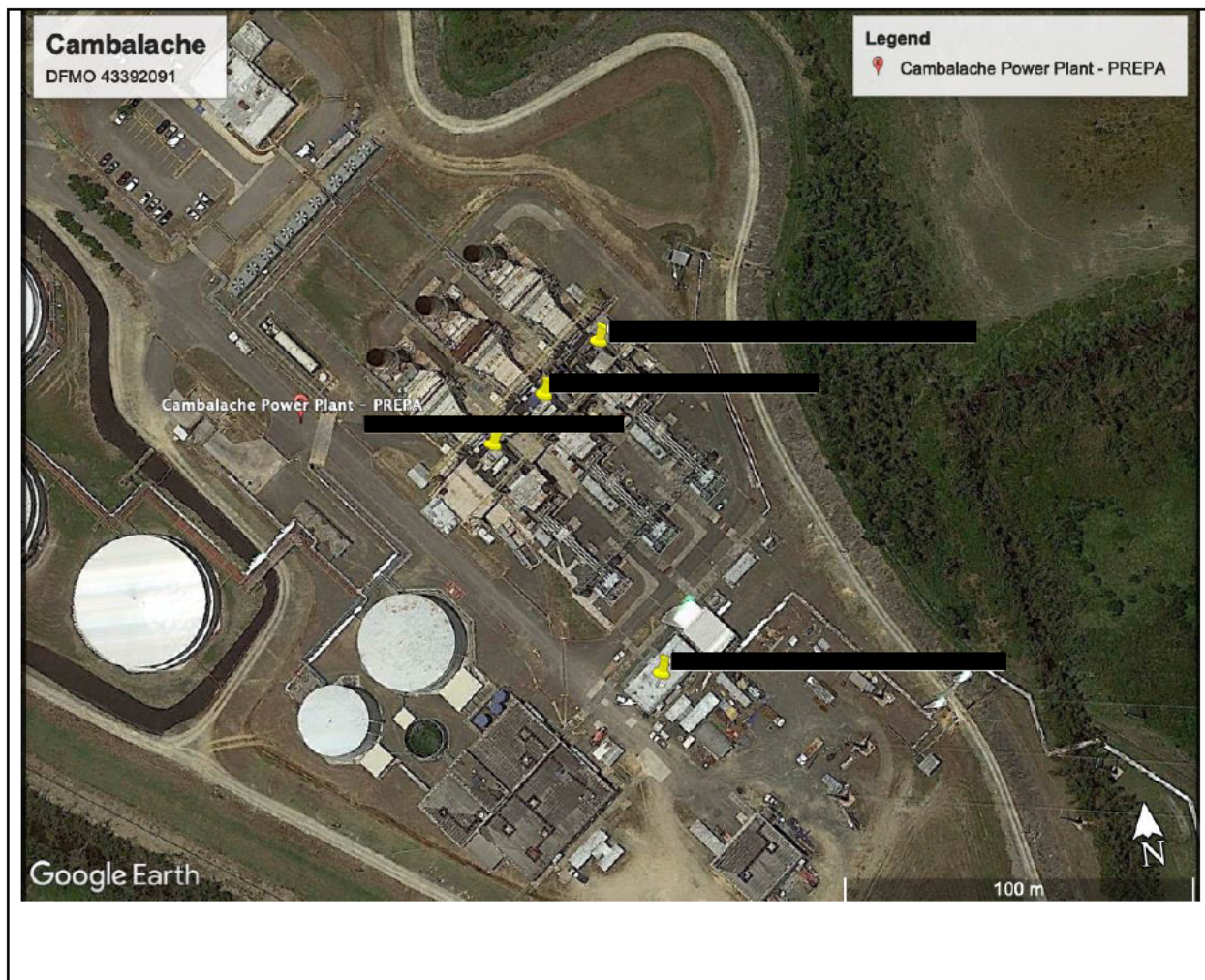
10.1. Project Detailed Cost Estimates

- Please see attached Proposal and Technical Specifications.

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures



10.4. Other: (Please Describe)

N/A

Project Name: Control System Power Plant Maintenance and Control Technical Services

Location: Cambalache Power Plant

Asset: Cambalache GT1, GT2 & GT3

Estimated cost: \$ 2,500,000

Asset Suite Data: A similar contract was valid thru the end of last fiscal year, contract 83244. Procurement process for a new contract has not been accomplished due to the lack of funds assignment in the current fiscal year budget. **All the included information and details were based in a** Proposal for a 2-year contract for Cambalache Power Plant and Aguirre Steam Plant.

General Description: Provide technical support and parts replacement for the generating unit control systems with Original Equipment Manufacturer trained technical advisors. The provided services will be a complete maintenance program for the continuous operations of the included equipment and its systems, especially for the obsolete equipment's. It will include parts replacement, software updates, backups, servers and network devices health issues solution and unexpected issues solutions. Provide 24-hour point of contact phone and email support and Gas Turbine Control, AVR, SFC and Vibro Smart System check and preventive maintenance.

Technical Description: The scope of work consists of provide technical support, troubleshooting, technical advisor and parts replacement for the following systems:

HMI (Human Machine Interface) maintenance

- Provide software maintenance releases, service packs, patches and updates
- Version upgrades
- New developed training and maintenance software
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- Perform screens and database modification/improvements as per PREPA Cambalache requests.

- Create HMI stations backup and images (one backup set for site, and one backup set for HTS).

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Automatic Voltage Regulator – Yearly Preventive Maintenance

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Automatic Voltage Regulator – 2 Year Preventive Maintenance

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Static Frequency Convertor – 2 Year Preventive Maintenance

- Check Overall system health
- Backup all Processor logic, card configuration

- Document all SME and Data alarms, explain and correct if required
- Check interface with plant control system
- Clean all components
- Check of all protection
- Thyristor health check
- Operation check and recording

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- Check Overall system health on HMI.
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- Basic operation check: Channel switchover from primary to backup system.

VibroSmart Pulsation System – 2 Year Preventive Maintenance

- Check Overall system health on HMI.
- Verify pulsation chains are fully connected.
- Backup all VibroSmart configuration files from Server to external disk.
- Document all VibroSmart/Pulsation alarms, explain and correct if required.
- Perform a pulsation chain check to verify there is no electronic component degradation. If there is, then replace the faulty component.
- Complete operation and protection check: Check interface with plant control system with complete operation and protection test that was performed at time of installation.

Training:

Training will be provide annually to technical personnel in the following

- ✓ ABB P13 tools and Hardware
- ✓ PAC Systems (P400) training
- ✓ HMI Training
- ✓ SFC Maintenance and operation.
- ✓ AVR Maintenance and operation.
- ✓ Pulsations Monitoring Maintenance and operation

Replacement Parts:

All failed covered parts will be repaired or replaced as required. This service is included as part of the Service and Maintenance Agreement.

Disposal:

PREPA Cambalache will retain all removed equipment and material for proper disposal according to applicable regulations.



HTS LATAM LLC
HUGHES TECHNICAL SERVICES
Power Plant Commissioning and Maintenance

January 19, 2022

Jorge Cotto
Generation Director
Puerto Rico Electric Power Authority

**Proposal for Control Systems and Power Plant Maintenance Consulting Services
For Aguirre and Cambalache facilities.**

Dear Eng. Cotto,

HTS LatAm is pleased to provide our proposal for Services and Maintenance Agreement for Cambalache and Aguirre Plants. As known HTS LatAm is a power plant commission and services company OEM trained in both plants systems and whose senior associates and partner companies have more than 25 years' experience.

Our personnel have had a strong relationship to Aguirre and Cambalache Power Plants systems, providing countless solutions, alternatives and improvements to their benefit.

This included proposal covers in more detail the following services:

- **All-inclusive Control system support and parts replacement**
 - Full software and hardware assistance and support for P400, Pro-Control, BlueLine , AVR, SFC, Proficy, iFix HMI and Pulsations Monitoring control systems.
 - Full parts repair/replacement for the previous mentioned systems.
 - 24/7 dedicated Engineers/Specialists for phone, VPN, TeamViewer, email and on-site assistance.
 - Improvements and upgrades options for obsolete equipment and systems
 - Expedite solutions for unexpected issues
 - Complete maintenance program and related services for:
 - Open and Closed loop control systems
 - Software updating, backups, network health
 - Commissioning for new installation and C inspections
 - AVR software and Hardware devices
 - Control systems training
 - On demand customer modification requirements
 - SFC software and Hardware devices
 - Servers devices proper functionality

Please see the attached proposal for services and rates.

Regards,

Luis Oscar Morales
Field Service/Office Manager
HTS LatAm

HTS LatAm
Rio Piedras Height 1684 Ural St.
San Juan PR 00926
TEL: +1 221 2850
FAX: +1 717 222 5261



HTS LATAM LLC
HUGHES TECHNICAL SERVICES
Power Plant Commissioning and Maintenance

HTS LatAm LLC PROPOSAL FOR SERVICE AND MAINTENANCE AGREEMENT

Aguirre and Cambalache Power Stations
#PR20220119 Rev D



(HTS LatAm)
Rio Piedras Height 1684 Ural St.
San Juan PR 00926
TEL: +1 221 2850
FAX: +1 717 222 5261
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(HTS LatAm)
Rio Piedras Height 1684 Ural St.
San Juan PR 00926
TEL: +1 221 2850
FAX: +1 717 222 5261
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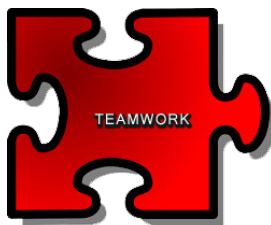
2. Introduction

HTS is a focused supplier of high-value consulting, engineering, commissioning and maintenance services to power plant owners worldwide, with a focus on Alstom/ABB legacy fleets.

Founded in January 2014 by ex-Alstom personnel, HTS has already amassed a significant customer base with several major contracts and projects obtained and completed. All key personnel are Ex ALSTOM or ABB employees or consultants.

HTS LatAm can completely service all aspects of ABB and ALSTOM gas and steam turbines from small troubleshooting assignments to major overhauls.

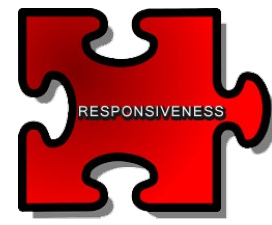
At HTS, we feel that our foundation is the key to success and the guiding force behind our company. Below are the pillars that constitute the foundation of HTS.



We strive at all times to maintain a collaborative work environment that nurtures open communication, learning, and the sharing of best practices and ideas. We demand close cooperation in all business ventures and strive to be the business partner possible



Honesty and integrity are key ingredients in developing trust. Trust is a key element in establishing credibility and our credibility is the heart of our corporate mission statement.



Response time is critical within our business and we at HTS deliver. We guarantee the highest level of responsiveness to our customers, partners, and teammates that meets and exceeds expectations. Our goal is to deliver on time, every time.



3. Safety

HTS maintains one of the most successful safety programs in our industry. Our commitment to the safety of our employees and those working around us is evident in our safety record, and echoed by the accountability and involved leadership that runs to the core of HTS. Our success is the direct result of our transition to a culture of ownership, where everyone is accountable from the CEO to the Technical Advisors and Engineers working at our client sites.

Through the rigorous implementation of our independent safety program, we have proven that accident-free performance is possible. Our success in this endeavor is best illustrated by our industry-leading safety performance. HTS's comprehensive Environment, Health and Safety (EHS) Program incorporates both Industrial and Environmental Safety and is based on the following key components:

❖ **Commitment**

At HTS, our commitment to safety starts with the CEO and is driven through all levels of management. Commitment to the safety of our clients and employees will always determine the success or failure of HTS, our goals, and our employees. Finally, our culture of ownership creates a professional workplace that places accountability and responsibility on each member of the HTS team.

❖ **Prevention**

HTS management is trained in accident prevention techniques and safety leadership skills. Job Safety Analysis (JSA) is used on all HTS sites as a planning tool to identify and address hazards in each work process. HTS also conducts mandatory weekly "tool box" meetings to cover other pertinent site safety issues

❖ **Adherence**

HTS will work under the most stringent of either our own corporate safety policies and philosophies or those provided by the client.

❖ **Assurance**

Site safety inspections are conducted daily. In addition, HTS assures the safety process implementation by auditing 100% of its work force annually.



❖ **Investigation**

Safety incidents are thoroughly investigated through HTS's safety department personnel to determine root cause, appropriate corrective measures and disciplinary action if and when appropriate.

❖ **Corrective Measures**

Thorough and prompt review and documentation of safety incidents is conducted uniformly across sites. Safety alerts are issued throughout the company to prevent repetition of mistakes or accidents across job sites. Finally, reports are catalogued and provided to the client so that both HTS and clients may collaborate on further corrective measures.

❖ **Proven Results**

Since inception HTS has shown continuous commitment in our safety performance, with a Total Recordable Incident Rate (TRIR) well below industry averages. We are extremely proud of the success of our safety program and we continue to strive for further improvement. The following recent achievements highlight the success of our program.

ZERO OSHA RECORDABLES Since inception of the company.

ZERO OSHA LOST TIME ACCIDENTS since inception of the company.

ZERO OSHA CITATIONS Since inception of the company.

❖ **Technical Expertise**

HTS can provide our own OEM-trained Technical Advisors, Project Management, Commissioning and Control systems Specialists and Engineers, and Subject Matter Experts as required. The experience and expertise of our personnel will greatly increase efficiency and maximize quality on the project-all while lowering the total project cost.

4. Executive Summary

HTS LatAm is proud to introduce our Service and Maintenance Agreement (LTSMA) for PREPA's Aguirre and Cambalache plants. We are committed to exceptional personalized service for your power plant needs and offer a wide-ranging array of maintenance, troubleshooting, upgrade and training programs that will aid your plant managers and operators and extend life cycle, increase availability and reduce costs of replacement parts.

Our maintenance service proposal guarantees fast response, expert troubleshooting and reliable maintenance. All engineers/specialists have been trained on the equipment covered and we absolutely guarantee all work performed.

In addition to this we can supply parts and are authorized to supply ALSTOM BlueLine modules which is the control system platform for both plants that are covered under this proposal.

HTS LatAm is uniquely qualified to serve PREPA's needs as principal employees and those to be assigned to the LTSMA are very familiar with both Plants covered under the LTSMA as follows:

(HTS LatAm)
Rio Piedras Height 1684 Ural St.
San Juan PR 00926
TEL: +1 221 2850
FAX: +1 717 222 5261
HTS-LLC.com

Cambalache

- Commissioning during new installation
- Operation support including OEM plant manager and shift supervisors
- P400/BlueLine control system upgrade
- P13 Procontrol upgrade
- SFC, and AVR PM – all Units
- Pulsations Monitoring system maintenance

Aguirre

- Control System upgrade
- HMI upgrade
- HMI maintenance
- AVR upgrade and troubleshooting/evaluation
- Transformers swap out commissioning

5. Scope of this Proposal

The services covered under this proposal apply to the following Plants/Units

- Cambalache Units 1, 2 and 3
- Aguirre Units 1 and 2

5.1 Site Services Included

Technical Support

Item 1	24 hour point of contact phone and email support – 24/7/365	✓
Item 2	24 hour response time for emergency site visits (time to initiate travel – actual arrival on site is dependent on external factors but not to exceed 36 hours) If issue not solved by phone, email, TeamViewer or VPN remote access first.	✓
Item 3	Remote Project management for major inspections and overhauls as related to the covered equipment	✓
Item 4	Remote Consulting services for major inspections and overhauls as related to the covered equipment	✓
Item 5	Discount on any other consulting services may apply	✓

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6. Software HMI and Control System

Item 1	Software maintenance releases, service packs, patches and updates	✓
Item 2	Version upgrades (see options)	✓
Item 3	HTS developed training and maintenance software	✓
Item 4	Install newest iFix and iHistorian SIMS (Software Improvement Modules) on all HMI stations	✓
Item 5	Network Switch upgrade	✓
Item 6	Discount on any other consulting services – in house rates apply	✓

7. HMI Maintenance

Item 1	Check Overall system health: hard drive space, hard drive partitioning.	✓
Item 2	Check for correct communication between HMI stations and controllers.	✓
Item 3	Perform SQL databases Maintenance: export and delete from live database out-of-date SOE entries (one new table per year will be created, and a new HMI screen will allow operation to access this table), perform SQL optimization.	✓
Item 4	Perform screens and database modification/improvements as per customer requests. – 5 days per year	✓
Item 5	Create HMI stations backup and images (one backup set for site, and one backup set for HTS).	✓

8. HMI Upgrades

Item 1 Aguirre	Unit operation concept change for Aguirre	✓
Item 2 Aguirre	Required number of new computer (with mouse and keyboard), running WIN10 64 bits operating system will be provided. Configuration of the station will be performed on site. (with option selected only – not included in proposal cost)	✓
Item 3	New 19" monitor(s) will be installed. (with option selected only – not included in proposal cost)	✓
Item 4	Newest iFix software will be installed on the HMI station, and the upgraded HMI application will be migrated. (with option selected only – not included in proposal cost)	✓
Item 5	Existing data (trend and sequence of events) will be migrated to the new HMI station (with option selected only – not included in proposal cost)	✓
Item 6	An image of the new HMI station will be created on a new portable USB hard drive. (with option selected only – not included in proposal cost)	✓



9. Gas and Steam Turbine Control System– Yearly Check

Item 1	Check Overall system health	✓
Item 2	Backup all Processor logic, card configuration	✓
Item 3	Document all SME and Data alarms, explain and correct if required	✓
Item 4	Review all operator concerns and suggestions, make minor modifications as agreed, eliminate nuisance alarms and correct logic errors	✓
Item 5	Replace all faulty cards	✓

10. Automatic Voltage Regulator – Yearly Preventive Maintenance

Item 1	Check Overall system health	✓
Item 2	Cleaning of all components	✓
Item 3	Backup all Processor logic, card configuration	✓
Item 4	Operation check, channel switchover	✓

11. Automatic Voltage Regulator – 2 Year Preventive Maintenance

Item 1	Check Overall system health	✓
Item 2	Cleaning of all components	✓
Item 3	Backup all Processor logic, card configuration	✓
Item 4	Document all SME and Data alarms, explain and correct if required	✓
Item 5	Check interface with plant control system	✓
Item 6	Calibrate all Transducers	✓
Item 7	Check all Protection	✓
Item 8	Operation check, channel switchover	✓

12. Static Frequency Converter – Yearly Preventive Maintenance

Item 1	Check Overall system health	✓
Item 2	Backup all Processor logic, card configuration	✓
Item 3	Document all SME and Data alarms, explain and correct if required	✓
Item 4	Check interface with plant control system	✓
Item 5	Operation check and recording	✓



13. Static Frequency Converter – 2 Year Preventive Maintenance

Item 1	Check Overall system health	✓
Item 2	Backup all Processor logic, card configuration	✓
Item 3	Document all SME and Data alarms, explain and correct if required	✓
Item 4	Check interface with plant control system	✓
Item 5	Clean all components	✓
Item 6	Check of all protection	✓
Item 7	Thyristor health check	✓
Item 8	Operation check and recording	✓

14. VibroSmart Pulsation Protection System – Yearly Preventive Maintenance

Item 1	Check Overall system health on HMI.	ü
Item 2	Verify pulsation chains are fully connected.	ü
Item 3	Backup all VibroSmart configuration files from Server to external disk.	ü
Item 4	Basic operation check: Channel switchover from primary to backup system.	ü

15. VibroSmart Pulsation Protection System – 2 Year Preventive Maintenance

Item 1	Check Overall system health on HMI.	ü
Item 2	Verify pulsation chains are fully connected.	ü
Item 3	Backup all VibroSmart configuration files from Server to external disk.	ü
Item 4	Document all VibroSmart/Pulsation alarms, explain and correct if required.	ü
Item 5	Perform a pulsation chain check to verify there is no electronic component degradation. If there is, then replace the faulty component.	ü
Item 6	Complete operation and protection check: Check interface with plant control system with complete operation and protection test that was performed at time of installation.	ü

16. Remote Service – Customer support

1 (one) HTS engineer/specialist will be assigned and dedicated 100% to both Aguirre and Cambalache Plant Support, the Plant Support Engineer/Specialist (PSES). The PSES will be single the point of contact for all issues regarding both plants. Issues and requests not within the PSES's skill set will be delegated to support personnel.

(HTS LatAm)
Rio Piedras Height 1684 Ural St.
San Juan PR 00926
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FAX: +1 717 222 5261
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17. Parts

All failed parts listed below will be repaired or replaced as required and this service is included as part of the Service and Maintenance Agreement Proposal (SMA)

Replacement of modules depends on obsolete status. HTS LatAm will commit to replace or repair modules with similar or upgraded devices and make all efforts to obtain used parts to repair systems to operating condition. In the event that modules are no longer available HTS LatAm will propose the best upgrades available which costs are not included in this proposal.

Item 1	Replace/repair all failed BlueLine (P13) modules	✓
Item 2	Replace/repair all failed PacSystems (P400) modules	✓
Item 3	Replace/repair all Fiber Optics patch jumper cables	✓
Item 4	Replace/repair all failed HMI servers and network switches	✓
Item 5	Replace/repair all failed SFC control modules	✓
Item 6	Replace/repair all failed AVR control modules	✓
Item 7	Replace/repair all failed Pulsations Monitoring control modules	✓

18. Consulting Services/Planning/Reporting

All Systems covered will be evaluated for potential failures and possible upgrades to improve reliability and maintainability. A yearly Assessment Report will be delivered for planning purposes.

The report will cover:

- Obsolescence status of equipment and prediction of when non OEM support dates
- Criticality of spares and status of existing stock with recommendations
- Upgrade possibilities and recommendation
- System weaknesses and possible improvements
- History of failures and issues
- Prediction of possible future failures

19. Training

Nine (9) days is included each year. Additional training can be provided at published HTS rates.

Training shall cover the following topics;

- ABB P13 tools and Hardware
- PAC Systems (P400) training
- HMI Training
- SFC Maintenance and operation.
- AVR Maintenance and operation.
- Pulsations Monitoring Maintenance and operation

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20. Exclusions

The following equipment and systems are specifically excluded from the SMA.

- Gas and steam turbine hardware, such as hot gas path parts etc.
- Gas and steam turbine auxiliaries such as pumps, motors valves etc.
- Instrumentation
- Cabling, wiring
- Trio Blocks
- Transducers
- Electrical Equipment such as transformers, contactors, switchgear etc.
- Steam cycle, parts and systems
- Water Cycle parts and systems
- Fuel delivery system
- CEMS
- Water treatment System
- Switchgear and Switchyard
- Main Fiber Optics Cables

21. Options

As part of the LTSMA the following upgrade options are offered at the prices listed below

	System	Cost \$
21.1	Cambalache Unit AVR upgrade ea (Electronics portion)	\$135,300.00
21.2	Cambalache Unit SFC upgrade ea (Electronics portion)	\$355,300.00
21.3	Aguirre HMI Upgrade 6 HMI servers for Aguirre from Windows XP to Windows 10. Includes required new hardware -Servers and Monitors, keyboards, Network Switches Hard drives, USB – includes all Software, MS, IFix, and devices.	\$752,522.00
21.4	Aguirre - AVR upgrade ea (electronics portion)	\$355,300.00
21.5	Cambalache Unit GMS Upgrade ea	\$77,420.00
21.6	Cambalache Unit SOE Upgrade ea	\$78,480.00

Detailed scopes in HTS LatAm proposal CAM20211014 (Included)

(HTS LatAm)
 Rio Piedras Height 1684 Ural St.
 San Juan PR 00926
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22. Cost and Payment Terms

The cost for the Service and Maintenance Program is:

2 year only SMA - \$995,000.00 **PER YEAR**
Total - \$1,990,000.00

Of this total cost, an amount of \$100,000.00 (One Hundred Thousand) USD will be destined for extra work services and parts that are not covered on the scope of this proposal as detailed in section 23 On Site Rates.

HTS LatAm will keep track of these hours, parts, etc. for extra work services and keep PREPA informed. Once the portion for extra works hours and parts are exhausted PREPA will have the option to issue a new PO separate from this contract.

This proposal is valid for 60 days from the date shown above.

Payment Terms:

	Description
Payments	8 payments to complete in 2 years (24 months)
1	1 st quarter payment (\$248,750.00)
2	2 nd quarter payment (\$248,750.00)
3	3 rd quarter payment (\$248,750.00)
4	4 th quarter payment (\$248,750.00)
5	5 th quarter payment (\$248,750.00)
6	6 th quarter payment (\$248,750.00)
7	7 th quarter payment (\$248,750.00)
8	8 th quarter payment (\$248,750.00)

Each payment should be delivered within 30 working days after delivery of invoice to PREPA.

(HTS LatAm)
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23. On Site Rates

The following rates apply to extra services in the proposal

23.1 Gas and Steam Turbine and Controls Commissioning Lead Commissioning Engineer/Specialist

Straight Time	first 8 hours worked, Monday through Friday	US\$380.00
Overtime	All hours worked Monday - Friday > 8 Hours and all-day Saturday	US\$420.00
Double Time	All hours worked Sunday and Holidays	US\$478.00

ALSTOM BlueLine/ABB ProControl P13/ABB Advant/ABB MOD300/P400 Engineer/Specialist

Straight Time	first 8 hours worked, Monday through Friday	US\$380.00
Overtime	All hours worked Monday - Friday > 8 Hours and all-day Saturday	US\$420.00
Double Time	All hours worked Sunday and Holidays	US\$478.00

AVR/LCI (SFC) ABB/ALSTOM/GE Generator Protection Commissioning Engineer/Specialist

Straight Time	first 8 hours worked, Monday through Friday	US\$395.00
Overtime	All hours worked Monday - Friday > 8 Hours and all-day Saturday	US\$435.00
Double Time	All hours worked Sunday and Holidays	US\$498.00

Gas and Steam Turbine Performance Engineer/Specialist

Straight Time	first 8 hours worked, Monday through Friday	US\$385.00
Overtime	All hours worked Monday - Friday > 8 Hours and all-day Saturday	US\$425.00
Double Time	All hours worked Sunday and Holidays	US\$488.00

Commissioning Technician

Straight Time	first 8 hours worked, Monday through Friday	US\$300.00
Overtime	All hours worked Monday - Friday > 8 Hours and all-day Saturday	US\$395.00
Double Time	All hours worked Sunday and Holidays	US\$425.00

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Balancing Engineer/Specialist

Straight Time	first 8 hours worked, Monday through Friday	US\$345.00
Overtime	All hours worked Monday - Friday > 8 Hours and all-day Saturday	US\$390.00
Double Time	All hours worked Sunday and Holidays	US\$465.00

HMI Engineer/Specialist

Straight Time	first 8 hours worked, Monday through Friday	US\$380.00
Overtime	All hours worked Monday - Friday > 8 Hours and all-day Saturday	US\$420.00
Double Time	All hours worked Sunday and Holidays	US\$478.00

GE Controls Engineer/Specialist Speedtronic, Mark Family, EX2100

Straight Time	first 8 hours worked, Monday through Friday	US\$375.00
Overtime	All hours worked Monday - Friday > 8 Hours and all-day Saturday	US\$495.00
Double Time	All hours worked Sunday and Holidays	US\$258.00

Woodward Controls & HMI Engineer/ Specialist /Micronet/Atlas/EAYsygen/MSLC-1, MSLC-2, DLSC-1, DLSC-2

Straight Time	first 8 hours worked, Monday through Friday	US\$395.00
Overtime	All hours worked Monday - Friday > 8 Hours and all-day Saturday	US\$525.00
Double Time	All hours worked Sunday and Holidays	US\$688.00

Rockwell Software/Allen Bradley Controllers Family-PLC5, SLC 500, Micrologix, Compactlogix, Contrologix Engineer/Specialist

Straight Time	first 8 hours worked, Monday through Friday	US\$380.00
Overtime	All hours worked Monday - Friday > 8 Hours and all-day Saturday	US\$420.00
Double Time	All hours worked Sunday and Holidays	US\$478.00



24. Gas and Steam Turbine Craft and TFA

24.1 TFA Rates

Scheduled Outage Rates (\$US)	Straight Time	Over Time (\$US)
Customer Representative	195.00 / Hour	225.00 / Hour
Project Manager	248.00 / Hour	285.00 / Hour
Technical Director	248.00 / Hour	285.00 / Hour
Technical Advisor	227.00 / Hour	265.00 / Hour
I&C Supervisor	229.00 / Hour	270.00 / Hour

Craft Rates

	ST (\$US)	OT (\$US)	PD (\$US)
1. General Foreman	66.00	89.00	150
2. Working Foreman	61.00	83.00	120
3. Millwright	47.00	64.00	120
4. Helper	38.80	53.00	120
5. Welder	62.00	84.00	120
6. Tool Room	38.00	52.00	120
7. Bolt Room	38.00	52.00	120
8. Electrician	100.00	150.00	120
9. I&C Tech	100.00	150.00	120
10. Overhead Operator	65.00	88.00	120

25. Terms and Conditions for On Site Support Personnel

- a. Meals and incidentals will be charged on a Per Diem rate in accordance with the published IRS rates or \$160.00 whichever is greater. (Excluding craft)
- b. Travel to and from site locally will be by rental car or private vehicle. Rental car shall be a full-size car. Use of private vehicle will be reimbursed on a mileage based at IRS allowed rates. Gas will be reimbursed at cost for rental cars only.
- c. Air travel less than 10 hours will use the lowest reasonable ticket class, on jobs that are subject to change, refundable tickets may be purchased. Travel in excess of 10 hours will use the lowest business class ticket.
- d. Workers shall use comfortable mid-range hotel accommodations such as Hampton Inn or Holiday Inn Express unless other accommodations are agreed to in advance. Use of private accommodations (friends or family) may be used in lieu of a hotel. It is expected that the worker will reasonably compensate the private party for the inconvenience and will be reimbursed at 0.5 times the rate that would have been paid for public accommodations.

Note: This exclude craft labor for which the per diem covers cost of lodging.

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e. Any required special equipment specific to customer assignments and not provided by customer will be billed at cost plus 15%. This includes safety clothing or equipment with customer logos. Generic safety equipment normally required on industrial sites will be provided by HTS.

f. The flowing charges will be added to expenses and billed amounts:

- Administrative charge of 15% will be added to all expenses.
- FONDO, LOCAL TAXES, ETC

26. Commercial Terms and Conditions

26.1 Definitions

HTS LatAm are all terms referring to the legal entity HTS LatAm LLC.
PREPA refers to the Puerto Rico Electric Power Authority

27. Scope of Services

The scope of services shall be provided and performed by parties in accordance with the terms and conditions set forth. Any work required by PREPA that is determined not covered under the scope of this agreement or as listed in section 20 EXCLUSIONS, will be billed based on HTS 2020/2021 rates. All services covered by HTS in this proposal are subject to a proper operation of equipment by PREPA personnel as stated by operational procedures and protocols.

28. Third-Party Beneficiaries

All duties and responsibilities undertaken pursuant to this Agreement will be for the sole and exclusive benefit of the Client and Consultant and not for the benefit of any other party. Nothing contained in this agreement shall create a contractual relationship with or a cause of action of a third party against either Client or Consultant.

29. Pricing

Labor is priced based on an 8 hour work day, Monday through Friday. Hours worked outside of these hours shall be billed at the overtime hourly rate except on Sundays and holidays and all time worked over 13 hours, which will be charged at the double time hourly rate unless otherwise stated. Pricing expires thirty days (30) from the date of this quote unless otherwise stated.

30. Cancellation

HTS will commit to supplying personnel as agreed, this may result in the rejection of other customer's projects. Any project cancelled by customer after issue of a purchase order or equivalent email indicating a firm commitment to a project and within two weeks of the anticipated start date will be billed at 25% of the expected PO amount.

(HTS LatAm)
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31. Payment

For the services stated in this quote, the Client agrees to pay the Consultant the compensation stated. Taxes, duties and FONDO are not included in this quote. The Consultant agrees to submit invoices quarterly for services rendered. Payment shall be made within thirty (30) days after invoice in US dollars unless otherwise stated in this quote. Payment shall be made by check or money order, or by wire transfer or credit card with Consultant's approval.

32. Changes

Client shall have the right to request changes in services in writing or verbally. Acceptance of the changes shall be at the consultant's discretion.

Consultant shall have the right to charge for additional services requested by the client, whether in writing or verbal, including time and expenses incurred. Additional services will be subject to the same terms as the original quote. Additional services will be annotated in the consultant's time report and billed along with the original service.

33. Indemnification

Consultant agrees to indemnify and hold Client harmless from damages, costs and losses, including reasonable attorney's fees, arising from the negligent performance of Consultant's services under this Agreement that may result in a violation of a third party's trade secrets, proprietary information, trademarks, or copyrights. Client shall give Consultant prompt notice of any claims of damage subject to this indemnity obligation and shall, at its own expense, provide its time and efforts to cooperate with Consultant's indemnification of Client.

34. Dispute Resolution

Client and Consultant agree that they shall first submit any and all unsettled claims, counterclaims, disputes, and other matters in question between them arising out of or relating to this Agreement to mediation.

35. Contract Duration / Termination of Contract

The proposed arrangement is valid for 2 years (24 months) after signature and starting on date agreed by HTS LatAm and PREPA. Time extensions are possible after revision of scope and costs previous to the end of the 2 years period or before if mutually agreed by HTS LatAm and PREPA.

The Client may terminate this Agreement prior to completion with written notice to the Consultant for convenience or for good cause. The Consultant (HTS LatAm) may terminate this Agreement prior to completion with written notice to the Client for convenience or good cause. Client agrees to pay for all services and expenses incurred up to notification of termination.

Failure of the Client to make payments when due, may be cause for suspension of services or ultimately termination, -unless and until Consultant has been paid in all full amounts due prior to termination for services, expenses, and other related charges.

Termination of Contract from customer on the 1st first year will be billed and agreed for payment to Consultant at a rate of 35% of the total contract amount.

Termination of Contract from customer on the 2nd second year will be billed and agreed for payment to Consultant at a rate of 25% of the total contract amount.

(HTS LatAm)
Rio Piedras Height 1684 Ural St.
San Juan PR 00926
TEL: +1 221 2850
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36. Ownership of Intellectual Property Rights

All programming, copyrightable works, writings, drawings, designs, or other works created or developed by Consultant or its personnel during the performance of this agreement and delivered to Client shall become the property of Client. Client does not grant to Consultant or its personnel any rights or licenses to the works delivered by it to the Client under this agreement. All copyright, patent, trade secrets, and other intellectual property rights arising out of the works created or developed by Consultant or its personnel in performance of this agreement shall be the exclusive property of Client.

37. Confidentiality

Each party acknowledges and agrees that any and all information concerning the other's business is "confidential and proprietary information." Each party agrees that it will not permit the duplication, use or disclosure of any such confidential and proprietary information to any person unless such use is to accomplish the project and for no other purpose.

38. Disclaimer of Warranties

The Consultant makes no warranties of any kind, whether express or implied, including but not limited to, any implied warranties of merchantability and fitness for a particular purpose. Except as set forth in these terms and conditions, Consultant makes no representation, warranty or covenant concerning the capabilities or performance of any personnel or service that Consultant might provide to the Client in connection with delivery or implementation of the software.

39. Clarifications

Neither Party will be liable for any failure or delay in performing an obligation under this Agreement that is due to any of the following causes, to the extent beyond its reasonable control: acts of God, accident, riots, war, terrorist act, epidemic, pandemic, quarantine, civil commotion, breakdown of communication facilities, breakdown of web host, breakdown of internet service provider, natural catastrophes, governmental acts or omissions, changes in laws or regulations, national strikes, fire, explosion, generalized lack of availability of raw materials or energy. For the avoidance of doubt, Force Majeure shall not include (a) financial distress nor the inability of either party to make a profit or avoid a financial loss.

Government of Puerto Rico

Puerto Rico Electric Power Authority



Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES
Submittal to COR3 and FEMA



***AVR & SFC Upgrade,
Cambalache Power Plant – units 2 & 3***

1/28/2022



Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes



Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	Cambalache Power Plant, units 2 & 3 – AVR & SFC Upgrade
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number (Formerly Project Worksheet)	136271 - MEPA078 PREPA Island Wide FAASt Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: <Name>

<Insert title here>

PREPA Project Sponsor: <Name >

<Insert title here>



Section 2. Facilities

2.1. Facilities List

Name		GPS Location
Cambalache Power Plant		
	unit 2	
	unit 3	

Note: GPS coordinates are required for all facilities.

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

Cambalache Power Plant needs an upgrade of the obsolete electronic parts for the Automatic Voltage Regulator (AVC) with the Synchronism Devices, and the Static Frequency Converter (SFC) systems for GT2 and GT3. The actual systems are the original ones installed in 1997. The requested services are a complete maintenance program for the continuous operations of the included equipment and its systems, especially for the obsolete equipment's. It will include parts replacement, software updates, backups, servers and network devices health issues solution, unexpected issues solutions, and Gas Turbine Control, AVR, SFC and Vibro Smart System check and preventive maintenance.

Section 3. Scope of Work

3.1. Scope of Work Description



The scope of work for the AVR & SFC Upgrade in Cambalache Power Plant units 2 and 3 will consist of the following:

- Provide technical support, troubleshooting, technical advisor, and parts replacement for the following systems:
 - HMI (Human Machine Interface)
 - Gas and Steam Turbine Control System
 - Automatic Voltage Regulator
 - Static Frequency Converter
 - VibroSmart Pulsation System

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards:** Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project:** Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
 - a. Other improvements, not required by codes and standards
 - b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate)
<i>If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.</i>
Restores to Codes/Standards

Note: If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.

3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.



Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?

4.1. Codes, Specifications, and Standards

Yes/No. If yes, describe how incorporated below.
<ul style="list-style-type: none"> • (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE) • (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE) • Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730B-2 - U.S. Department of Agriculture Rural Electric Service (RUS) • International Building Code (IBC) - International Code Council (ICC) • International Energy Conservation Code (IECC) - International Code Council (ICC) • International Existing Building Code (IEBC) - International Code Council (ICC) • National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers • National Electrical Code (NEC) - National Fire Protection Association (NFPA) • FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.
<ul style="list-style-type: none"> • 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA) • 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA) • ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE) • International Building Code (IBC) - International Code Council (ICC) • Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA) • Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA) • RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS) • Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.

Cost Type	Amount (\$M)
Technical Services and Parts	\$1,043,000.00
Total Project Estimated Cost	\$1,043,000.00



Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: If available, detailed engineering cost estimates will be included as an attachment.

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

Program Manager's Printed Name

Date

Title

Signature

Section 9. PREPA Project Sponsor Comments

Comments
<Insert any comments here>

PREPA Project Sponsor's Printed Name

Date

Title

Signature



Section 10. Attachments

10.1. Project Detailed Cost Estimates

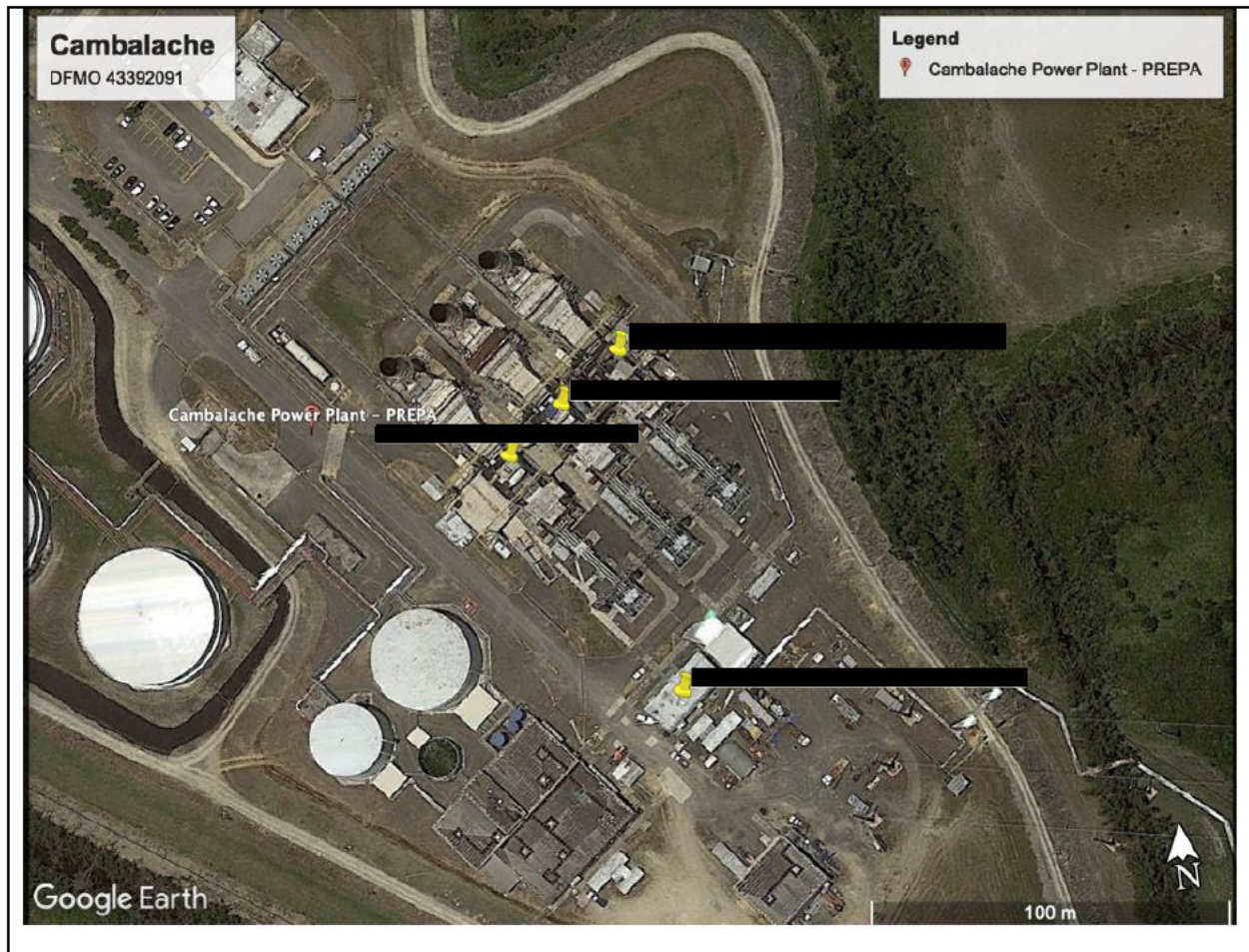
Please see attached the following:

- Justification, SOW and Cost Estimate_AVR & SFC Upgrade GT2 & GT3
- Proposal EXCS-19-92 v1_ABB

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures



10.4. Other: (Please Describe)

N/A

Project Name: Control System Power Plant Maintenance and Control Technical Services

Location: Cambalache Power Plant

Asset: Cambalache GT1, GT2 & GT3

Estimated cost: \$ 2,500,000

Asset Suite Data: A similar contract was valid thru the end of last fiscal year, contract 83244. Procurement process for a new contract has not been accomplished due to the lack of funds assignment in the current fiscal year budget. **All the included information and details were based in a** Proposal for a 2-year contract for Cambalache Power Plant and Aguirre Steam Plant.

General Description: Provide technical support and parts replacement for the generating unit control systems with Original Equipment Manufacturer trained technical advisors. The provided services will be a complete maintenance program for the continuous operations of the included equipment and its systems, especially for the obsolete equipment's. It will include parts replacement, software updates, backups, servers and network devices health issues solution and unexpected issues solutions. Provide 24-hour point of contact phone and email support and Gas Turbine Control, AVR, SFC and Vibro Smart System check and preventive maintenance.

Technical Description: The scope of work consists of provide technical support, troubleshooting, technical advisor and parts replacement for the following systems:

HMI (Human Machine Interface) maintenance

- Provide software maintenance releases, service packs, patches and updates
- Version upgrades
- New developed training and maintenance software
- Install newest iFix and iHistorian SIMS (Software Improvement Modules)
- Network Switch upgrade
- Check Overall system health: hard drive space, hard drive partitioning.
- Check for correct communication between HMI stations and controllers.
- Perform SQL databases Maintenance: export and delete from live database out-of-date SOE entries (one new table per year will be created, and a new HMI screen will allow operation to access this table), perform SQL optimization.
- Perform screens and database modification/improvements as per PREPA Cambalache requests.

- Create HMI stations backup and images (one backup set for site, and one backup set for HTS).

Gas and Steam Turbine Control System– Yearly Check

- Check Overall system health
- Backup all Processor logic, card configuration
- Document all SME and Data alarms, explain and correct if required
- Review all operator concerns and suggestions, make minor modifications as agreed, eliminate nuisance alarms and correct logic errors
- Replace all faulty cards

Automatic Voltage Regulator – Yearly Preventive Maintenance

- Check Overall system health
- Cleaning of all components
- Backup all Processor logic, card configuration
- Operation check, channel switchover

Automatic Voltage Regulator – 2 Year Preventive Maintenance

- Check Overall system health
- Cleaning of all components
- Backup all Processor logic, card configuration
- Document all SME and Data alarms, explain and correct if required
- Check interface with plant control system
- Calibrate all Transducers
- Check all Protection
- Operation check, channel switchover

Static Frequency Convertor – Yearly Preventive Maintenance

- Check Overall system health
- Backup all Processor logic, card configuration
- Document all SME and Data alarms, explain and correct if required
- Check interface with plant control system
- Operation check and recording

Static Frequency Convertor – 2 Year Preventive Maintenance

- Check Overall system health
- Backup all Processor logic, card configuration

- Document all SME and Data alarms, explain and correct if required
- Check interface with plant control system
- Clean all components
- Check of all protection
- Thyristor health check
- Operation check and recording

VibroSmart Pulsation System – Yearly Preventive Maintenance

- Check Overall system health on HMI.
- Verify pulsation chains are fully connected.
- Backup all VibroSmart configuration files from Server to external disk.
- Basic operation check: Channel switchover from primary to backup system.

VibroSmart Pulsation System – 2 Year Preventive Maintenance

- Check Overall system health on HMI.
- Verify pulsation chains are fully connected.
- Backup all VibroSmart configuration files from Server to external disk.
- Document all VibroSmart/Pulsation alarms, explain and correct if required.
- Perform a pulsation chain check to verify there is no electronic component degradation. If there is, then replace the faulty component.
- Complete operation and protection check: Check interface with plant control system with complete operation and protection test that was performed at time of installation.

Training:

Training will be provide annually to technical personnel in the following

- ✓ ABB P13 tools and Hardware
- ✓ PAC Systems (P400) training
- ✓ HMI Training
- ✓ SFC Maintenance and operation.
- ✓ AVR Maintenance and operation.
- ✓ Pulsations Monitoring Maintenance and operation

Replacement Parts:

All failed covered parts will be repaired or replaced as required. This service is included as part of the Service and Maintenance Agreement.

Disposal:

PREPA Cambalache will retain all removed equipment and material for proper disposal according to applicable regulations.



EXCITATION CENTER OF EXCELLENCE - AMERICAS

ABB Budgetary Proposal

UNITROL[®] M & LCI Control Upgrade

Customer: PREPA
Cambalache

ABB Reference #: EXCS-19-92 v1

Date:	October 14th, 2021	Prepared by:	Javier Mujica
Offeror:	ABB Inc. – Campus Montréal 800 Hymus Boulevard Saint-Laurent, QC H4S 0B5	Cell:	514-386-5092
		Email:	javier.mujica@ca.abb.com



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Mr. Herminio Arroyo
Email: herminio.arroyo@prepa.com

Subject: Budgetary proposal for the UNITROL® M and LCI Control Upgrade

Dear Mr. Arroyo,

Please find enclosed a budgetary proposal for the Control Upgrade solution applicable to the ABB UNITROL® M Excitation Systems (units 2 and 3) and LCI located at Cambalache.

As an option to extensive spare part investments and maintenance programs, ABB's control upgrades are time and cost effective solutions, improving the performance and extending the life cycle of operational equipment at minimal cost. As a major player in the excitation business, ABB can offer you the competence and the experience you need for a successful technological upgrade of your systems.

ABB's excitation team has experience upgrading systems in North America. During the last few years, we have upgraded multiple systems with outstanding customer satisfaction.

ABB has over 100 years of experience in Excitation Systems and Static Frequency Converters, 40 years of which have been here in North America. Our Montréal, Canada facility is ISO 9001 certified in Design, Project Management, Manufacturing, Testing & Servicing. We have also been ISO 14001 certified in Environmental standard since 1999.

Please refer to the enclosed sections for details of the proposed technical solution. We ask you to please keep all technical and supporting information confidential.

Should you have any technical or commercial questions, please do not hesitate to contact us.

Best Regards,

A handwritten signature in dark ink, appearing to read 'Jm7-7-3', is positioned above a horizontal line.

Javier Mujica
Service Sales engineer
Excitation Systems

A handwritten signature in dark ink, appearing to read 'Chadi', is positioned above a horizontal line.

Chadi Mourad
Manager, Projects and Service Sales
Excitation Systems

1 Executive Summary

ABB, over a 100 years of Excitation experience applied to power plants excitation systems control upgrades

The control upgrade will be designed, manufactured, tested, and managed from our Montréal, Canada facility. Our capabilities include the following: Sales and Marketing, Project Management, Design, Assembly, Factory Testing, Commissioning, Customer Training, After-Service and 24/7 Telephone Support.

Our manufacturing facility includes an advanced training center (demo units and on-site simulator are available) as well as a fully equipped test area. Type tests have been performed on all of our core equipment used for the excitation system.

As part of our optimization services, we offer control upgrades for the UNITROL M and LCI PSR2 that can extend the life and reliability of your system. We do this by retrofitting with the latest excitation technology: the UNITROL 6080.

Why consider a control upgrade to the UNITROL 6080?

Faster processing speed, data recording and exchange

- High performance control platform with extensive processing functions depending on the applied application programs of the device (ControlIT, Matlab/Simulink and FPGA). Processing functions include a RealTime Clock provides exact time measurement and time stamp;
- ABB researches and develops its own technology;
- High performance I/O platform based on PEC80 control platform with features including optical module, 12 digital inputs, 16 digital outputs, 3 analog inputs, 3 analog outputs and 3 PT100/PTC inputs.

Easy to monitor, maintain and troubleshoot

- User-friendly touch-screen Excitation Control Terminal (ECT)

Optimized contribution to network stability

- Integrated Power System Stabilizer (PSS), based on IEEE 2A/2B, or 4B (PSS Study & Re-Tuning optional, details in Addendum A)



Further advantages of a control upgrade

- Extension of the system's life cycle
- Reuse of the power section
- No change to the existing equipment footprint
- More cost-effective than a full-system replacement



Main features of the control upgrade:

		UNITROL® M	UNITROL® 6080
FUNCTIONS	Power System Stabilizer (PSS)	Hardware module	Software included as a standard
	Rotating diode monitoring	Hardware module	Software included as a standard
INTERFACE	Human-Machine Interface (HMI)	Control Panel for basic operation based on 4-line text	Excitation Control Terminal (ECT) – optional full graphic user interface can be installed on the system and/or remotely Step response capability
	Fieldbus protocol	Modbus / Profibus	Modbus / Profibus Modbus TCP Ethernet NTP Time Synchronization capability
	Digital I/O	16/16 (optional 32/32)	12 (expandable to 48) / 16 (expandable to 64)
	Analog I/O	2/2 (optional 4/4)	3/3 (optional 12/12) 3 channel PT100/PTC input Segregated I/Os per channel (option)
	Software	Commissioning and Maintenance Tool (CMT)	Excitation Control Terminal Software (ECT SW) Control Builder Windows 7/10 compatible
ARCHITECTURE	Channel configuration	Single/redundant 1+1 channel	Single/redundant 1+1 channel
	Communication between control channels	Flat ribbon cable	Fiber optic for high electromagnetic interference immunity

ABB UNITROL™ P Excitation System installed at Cambalache is in the Obsolete phase of the product life cycle, spare parts are extremely limited due to obsolescence



Benefits of ABB's Control Upgrade:

- **ABB is OEM of existing equipment.** EXTENSIVE knowledge and ownership of design documents, REDUCED risk significantly for accurate technical design.
- The **Excitation Systems** including the Automatic Voltage Regulators & Thyristor Converters are **developed, manufactured, tested and serviced by ABB**. Therefore, **ABB has full control over the technology** being supplied and ensures that **full long-term support** on this equipment will be provided for the next 15 years.
- With the **unmatched service support team** and the **proximity of our manufacturing facility to the plant**, ABB will be able to support PREPA's Excitation Systems rapidly.
- **ABB is the Original Equipment Manufacturer (OEM) and is uniquely positioned to conduct this control upgrade on the UNITROL systems.**
- **Smooth Engineering and Site Execution:** The preparation for the work includes a detailed analysis of Unitrol M design and selection the latest and most advanced control boards and electronic components. A detailed step-by-step procedure and sequence for component replacement and required changes and electrical connections.
- The upgrade design and drawings will be prepared by expert **engineers from Excitation Center of Excellence**.
- **All site activities including demolition, installation and commissioning will be performed by an experienced Excitation Field Applications engineer** with many years of technical field experience and certification in ABB excitation systems.
- **Experienced project management team with years of lessons-learned from other similar control upgrade projects, quality assurance and document control processes ensuring the solution provided meets and exceeds PREPA's requirements in functionality, performance, quality and documentation**
- **Long-term Support:** ABB's service support by Excitation Center of Excellence team, **available 24/7/365 to serve the clients remotely or via quick mobilization to site**. Customer-friendly access to technical training, spare parts, performance review services and studies ensuring many years of life for the existing PREPA assets.
- **In case of failure of any component, PREPA will only need to contact ABB for support.**

With over 1800 Excitation Systems installed in North America and more than 120 Excitation Systems Control Upgrades executed in the past years, ABB is fully capable of executing the PREPA UNITROL M Control Upgrade to UNITROL 6080 Excitation system. The manufacturing and construction of the project equipment consists of the following items:

- Engineering
- Manufacturing
- Site Acceptance Testing
- Removal and Installation
- Commissioning
- PSS recommissioning
- NERC Compliance
- Training



Manufacturing and Testing

Modernized facility Certified **ISO9001:2015**, **OHSAS:18001** with UL and CSA capability as well as **UL 508C:2016 Ed.4**. Over 60,000 ft² of manufacturing capability with 45 unionized employees in manufacturing, 10 unionized employees in material management (shipping and receiving). Skillful and experienced workforce. Dedicated Excitation Systems assembly line for various custom-built units. Our Test Facility is equipped with several test stations capable of performing different functional / type tests and meeting the highest industry and customer standards. As per the schedule included in this submittal, we have reserved the appropriate staff and machinery for the execution of this contract.

Service and Support

ABB has the largest dedicated Excitation System group and an unmatched service support network.

We have a technical support service line (1-800-HELP-365) available 24/7/365 free of charge. We also have a responsive service team ready for emergency travel. 15 Full time skilled Service Engineers and 2 fully dedicated Service Project Managers are available to support our customers with:

- 24/7/365 Telephone Emergency Support
- Technical Support Remote & on site
- Operations & Maintenance Training
- Emergency onsite support
- Scheduled Preventative Maintenance
- Installation & Commissioning of Excitation Systems
- PSS tuning & NERC compliance

2 Experience in system upgrades

We have extensive experience in upgrading ABB Excitation Systems to the newer UNITROL® 6000 generation.



Reference map example of ABB Excitation Systems installed and in operation in Canada and the United States. Each dot represents a power plant, where there could be multiple UNITROL exciters.

Please find below a few of our latest projects:

LOCATION	SYSTEM UPGRADE	# OF UNITS
Louisiana, USA	Upgraded to UNITROL® 6800	8
California, USA	Upgraded to UNITROL® 6800	5
Wisconsin, USA	Upgraded to UNITROL® 6080	1
Delaware, USA	Upgraded to UNITROL® 6080	1
Indiana, USA	Upgraded to UNITROL® 6800	2
Washington, USA	Upgraded to UNITROL® 6080	11
Ohio, USA	Upgraded to UNITROL® 6080	6
Oklahoma, USA	Upgraded to UNITROL® 6080	1
Pennsylvania, USA	Upgraded to UNITROL® 6080	1
Louisiana, USA	Upgraded to UNITROL® 6080	1
Nebraska, USA	Upgraded to UNITROL® 6080	1
Nebraska, USA	Upgraded to UNITROL® 6080	2
Illinois, USA	Upgraded to UNITROL® 6800	2
California, USA	Upgraded to UNITROL® 6080	8
California, USA	Upgraded to UNITROL® 6800	1
Tennessee, USA	Upgraded to UNITROL® 6800	4



Arkansas, USA	Upgraded to UNITROL® 6080	3
California, USA	Upgraded to UNITROL® 6080	2
Iowa, USA	Upgraded to UNITROL® 6080	8
Missouri, USA	Upgraded to UNITROL® 6080	8
Hawaii, USA	Upgraded to UNITROL® 6080	3
Kentucky, USA	Upgraded to UNITROL® 6080	4
Mamquam, BC, Canada	Upgraded to UNITROL® 6080	2
Indiana, USA	Upgraded to UNITROL® 6080	1
Guayama, Puerto Rico, USA	Upgraded to UNITROL® 6080	2
Massachusetts, USA	Upgraded to UNITROL® 6080	2

*For detailed references including contact name and phone numbers, please consult ABB.

3 Equipment scope of supply UNM Control upgrade

3.1 ABB's Technical solution – Excitation System control upgrade equipment

The Control Upgrade to the UNITROL 6080 includes the following:

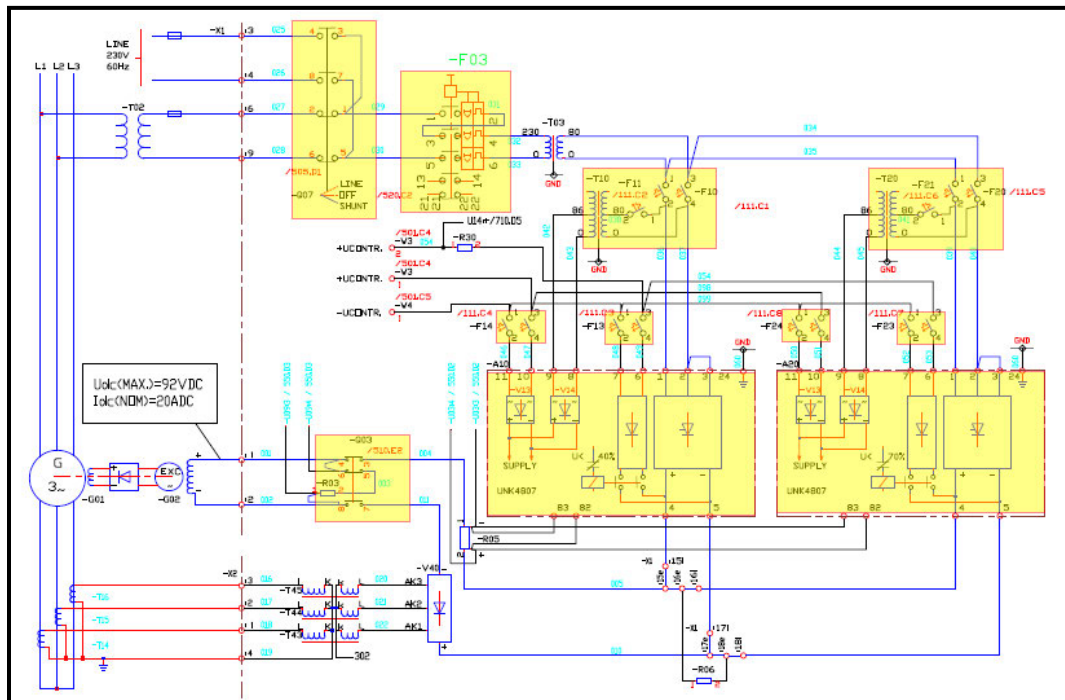
- The channel is equipped with its own microprocessor and firing circuit and consists of:
- An automatic voltage regulator and a manual field current regulator (back up mode)
- Automatic, manual, and PF/VAR control regulators
- Bi-directional follow-up function for bump-less transfer from auto/manual and between channels
- Maximum field current limiter, load angle (minimum) limiter and V/Hz (flux) limiter
- V/Hz (59F) and loss-of-field (40) software protections
- Generator PT monitoring.
- Power System Stabilizer (PSS) IEEE type 2A/2B. This function is embedded in the control electronics (NERC MOD 26/PRC19 Study & Re-Tuning are optional, details in Addendum A)
- Provision for remote control, metering and annunciation via hardwired I/O and Fieldbus protocol
- A Service Control Panel (SCP) per channel for fault annunciation, local control, and display of measuring or processing data
- Touch screen HMI: 15" Excitation Control Terminal (ECT) mounted on the exciter cubicle for fault annunciation, local control, and display of measuring or processing data (details in Addendum B)
- Two (2) Combined I/O board(s) as per original number of I/O boards of the unit to be upgraded
- Dedicated individual power supply circuit for each channel. Each individual power supply circuit is equipped with AC and DC voltage inputs for redundancy
- New Ethernet switch to ease the communication with controllers
- Engineering Services: Removal, installation, installation supervision and commissioning (details in section 4.1)

➤ Clarifications

- ABB will replace the door and back plate of the cabinet
- ABB will ship the new control section mounted on panels
- New Control Panels will fit within the existing cabinet
- Synchrotact 4 upgrade is included in the scope
- PREPA will have only 5 days - to review in parallel the drawings for the excitation & LCI. Design freeze needs to be reached within the 5 days after drawing submittal for both (UNM & LCI)
- Installation & commissioning: Sunday & Saturday have been identified as working days

- The following parts will be replaced by new components on units 2,3.

Parts to be Replaced



3.2 Project Documentation

UNITROL M Control Upgrade to the UNITROL 6080 includes the following final documentation that will be delivered after installation and commissioning of the upgraded unit:

- Revised original Circuit Diagram
- Revised original Wiring List
- Site Acceptance Test and Commissioning procedure
- Commissioning report and customer acceptance certificate
- Software package including software backups and list of parameters
- O&M manual for the new equipment

3.3 Clarifications

- Demolition markups of existing excitation equipment and circuit diagram of the new equipment can be provided for information only during project execution and an ABB engineer will be available to answer



any design-related questions that customer may have. Any request for design change will be reviewed by ABB and quoted accordingly.

- Current proposal is based on ABB standards. If you have any special or additional requirement, please advise ABB.
- ABB will engineer the control upgrade based on the latest drawings revision of each ABB Excitation System. A copy of the latest site modifications documentation should be provided to ABB. If the site drawings are not available, the as-commissioned drawings (or any later ABB service revision) will be used. If modifications have been made to the original design, ABB can, upon customer's request, provide a quote for a site audit in order to collect information about the modifications. ABB is assuming that all wiring, cable and bus will be reused except the ones covered by the upgrade. If wiring, cabling or bus needs to be replaced, ABB will provide a quote to the customer.
- ABB will provide the new controllers, components and sub-assemblies to be mounted on the existing panels, doors or mechanical structures.
- Parameters for regulators and PSS (if applicable) are not directly transferable from obsolete controller to new controller. All regulators will be re-tuned during commissioning except optional PSS tuning. See Addendum A for details.

3.4 Customer responsibilities

- Proper storage of the equipment shipped until installation;
- Integrity of the interface signals (digital inputs & outputs, analog inputs, supplies, etc.);
- Disposal of the material that will be removed on-site;
- Complete de-energizing of the unit and execution of the Lock-Out/Tag-Out of the unit prior to arrival of the ABB representative for removal/installation work;
- Provide resource visual contact or equivalent during installation and commissioning for health & safety purposes.

3.5 Exclusions

- All connection cables and bus ducts external to the excitation cubicles and excitation transformer;
- Anything not specifically included in the proposal.

4 Description of the Engineering Services

4.1 Description of the Engineering Services

The estimated engineering services detailed below are based on the average duration for similar past projects. Flights, travel days and sustenance are included for all engineering services below (removal, installation and commissioning). The on-site work is calculated taking into consideration one trip for the installation and commissioning per each unit. Please advise if your company's policy doesn't allow for weekend work.

4.2 Site Removal/Installation

ABB will provide one (1) commissioning engineer and one (1) installer for the removal and installation during the scheduled outage. The scope of work consists of the removal of the old components from the Excitation cubicles, installation and connection of the new components, and verification. Estimated at approximately eight (8) ten-hour days for each unit.

4.3 Site Commissioning

On the same trip, the commissioning engineer will perform the following scope of work: Test of control functions, digital and analog input/output interface, and functional test of the excitation regulator and its supervision functions. Synchrotact 6 commissioning is included. This consists of approximately seven (7) 10-hour day, as continuous workdays.

4.4 Site Engineering

In order to ensure that the technical scope of the control upgrade is confirmed, ABB will perform a site audit to inspect the equipment. This site engineering is applicable for the UNM and LCI control upgrade. The site audit takes 30 hours; it is done after the purchase order is confirmed and before the start of engineering.

The activities to be performed are the following:

- Perform a complete visual inspection of the drive (feeder breaker, transformer, converter, DC-Reactor and motor).
- Validate site specific information (location of the drive, accessibility, lifting equipment, shutdown time, drawings, etc)
- Identify additional site drawings required.
- Check the dimensions where the installation plates are going to be mounted



- Compare schematics with actual installation to identify any deviation
- Validate cable/wiring list and connection points on site.
- Verify the openings and routing to bring equipment in place.

During the site audit, ABB personnel appreciate the full support of the customer in order to complete the aforementioned tasks. The customer must allow shutdown for the converter in order to safely open the doors.

After the site audit is complete, ABB will provide a report with the findings and recommendations. Please keep in mind that if during the site audit any components of the power section need to be maintained or replaced, the customer will be informed.

4.5 Training

ABB will provide one (1) session of the Operation & Maintenance Training for the Unitrol 6080.

This includes:

- 3-days training given at customer site.
- Class size of four (4) people maximum.

If any additional working time, waiting time, delays or additional trips to site are required to complete work, they will be billed as per the applicable ABB Standard Schedule of Rates for Excitation Systems of the year during which they take place.

5. LCI Control upgrade Introduction

This document gives an overview of the modified components inside the MEGADrive-LCI, LCI.ST-BR1-A0606-211N465, Block #262 & 263, with control Platform PSR2 during the control upgrade to the AC 800PEC controller for two units. Furthermore, it clarifies the technical responsibilities and the interfaces between the customer and ABB for the upgrade.

5.1. Management summary

The goal of the offered control upgrade is to modify the existing PSR 2 based MEGADrive-LCI drive to the state of the art control system, which uses the AC 800PEC controller. This upgrade is performed with a combination of engineering, factory assembly and testing, as well as on-site installation and commissioning. In order to reduce the converter down time, the new components will be preassembled and tested in the manufacturer's factory.

The new control system will affect the existing thyristor firing concept in the power part.

- A new light interface (LIN) will be installed and via fiber optic cables and the medium voltage gate driver, the firing pulse will be transferred to the thyristor.
- The new control platform also provides a new user interface (LCT) to the operator, which will be mounted in the new door of the control cubicle.

The Power section of the current drive will not be replaced. Only the Control sections will be upgraded to the newest ABB Technology. Therefore, the upgrade represents significant financial savings.

5.2 Upgrade Advantages:

- AC800 PEC offers the features of the newest technology
- AC800 PEC controller is in the "active" phase of the product lifecycle; therefore, availability of spares is guaranteed for many years

The biggest difference between replacement of the whole converter and a control upgrade is that total assembly and commissioning time can be reduced. Also, no changes in existing supply transformer and motor cabling are needed. Therefore, the upgrade represents significant financial savings.

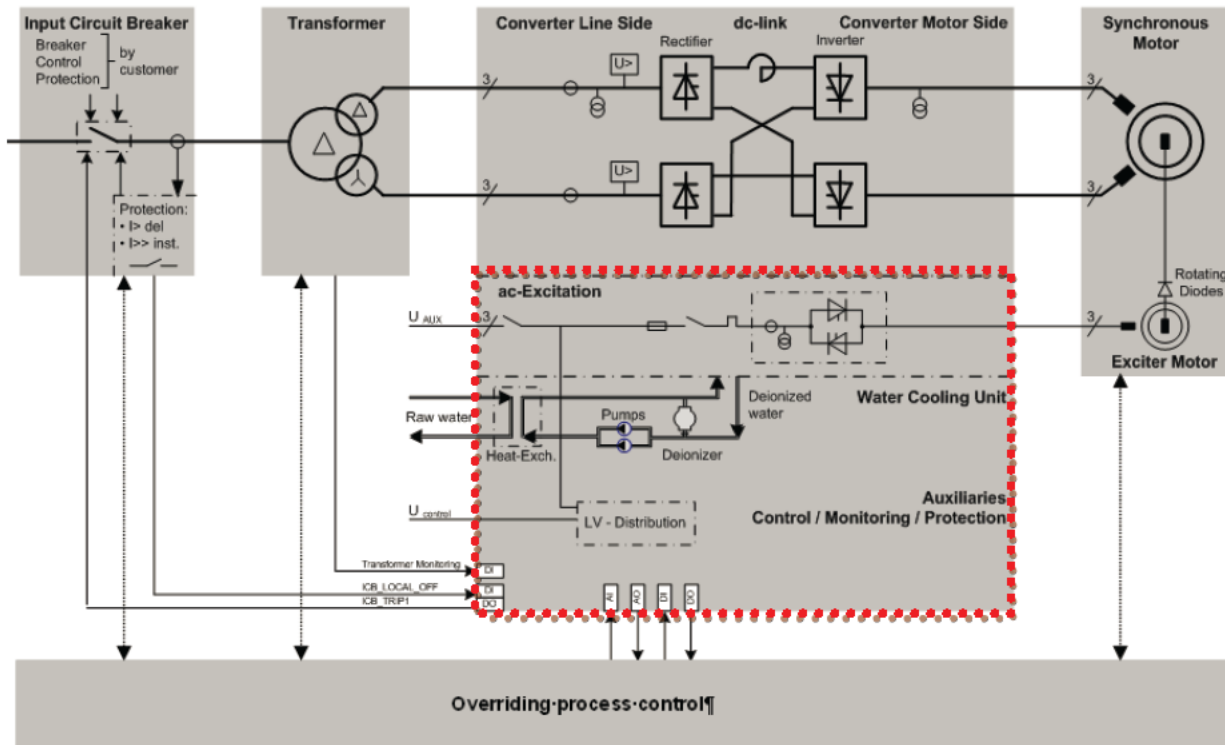
In conclusion, the control upgrade of the Megadrive-LCI will extend the life cycle of the existing system. ABB has the experience needed to execute the upgrade with outstanding results.

6. Overall concept

6.1 General overview

The diagram below shows the overall view of the starting equipment system, including input circuit breaker, transformer and motor/generator. The red square represents a general overview of the control upgrade scope.

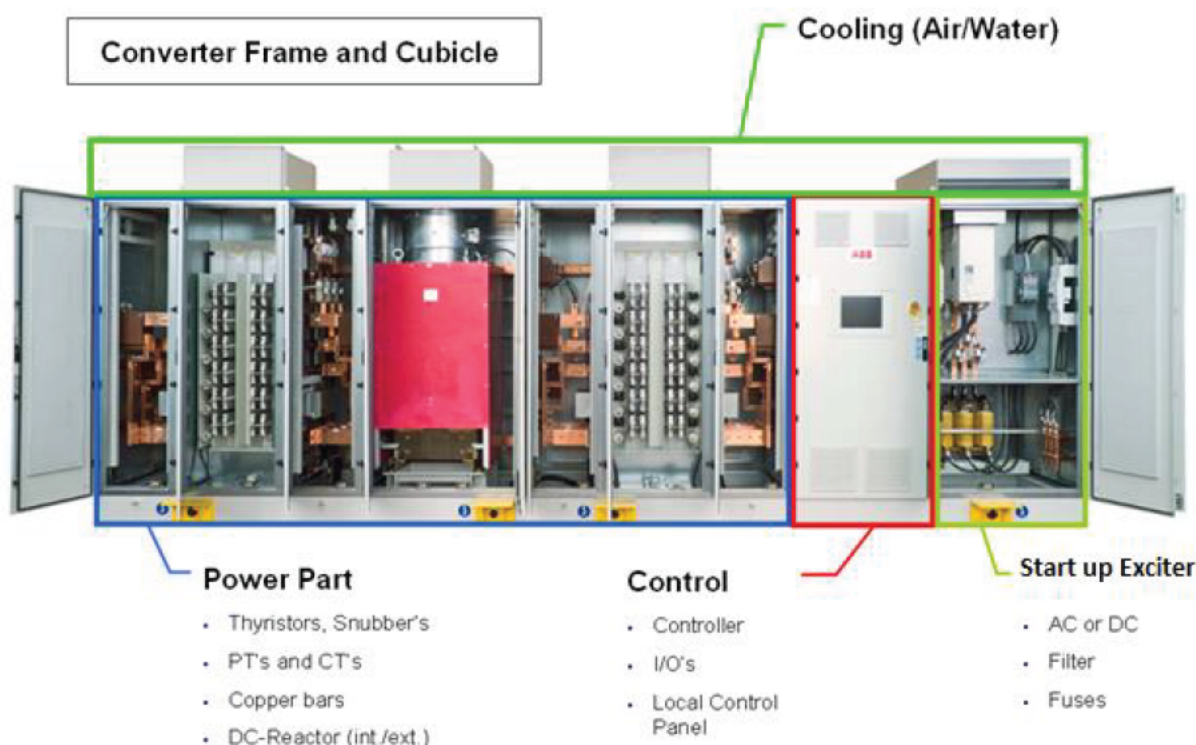
The control upgrade is done inside the existing drive cubicles. Therefore, the scope is limited to the inside of the converter. The customer interface remains.



Although one of the main purposes of LCI Control Upgrades is to have a minimal impact on the plant interface, it should be considered that, following the technical site audit, a slight modification of LCI interface might be required to accommodate new control components and functionalities (for example, the new controllers have to be supplied with permanent power supplies). These minor modifications will be communicated to the customer at the very beginning of the project in order for the customer to take appropriate actions.

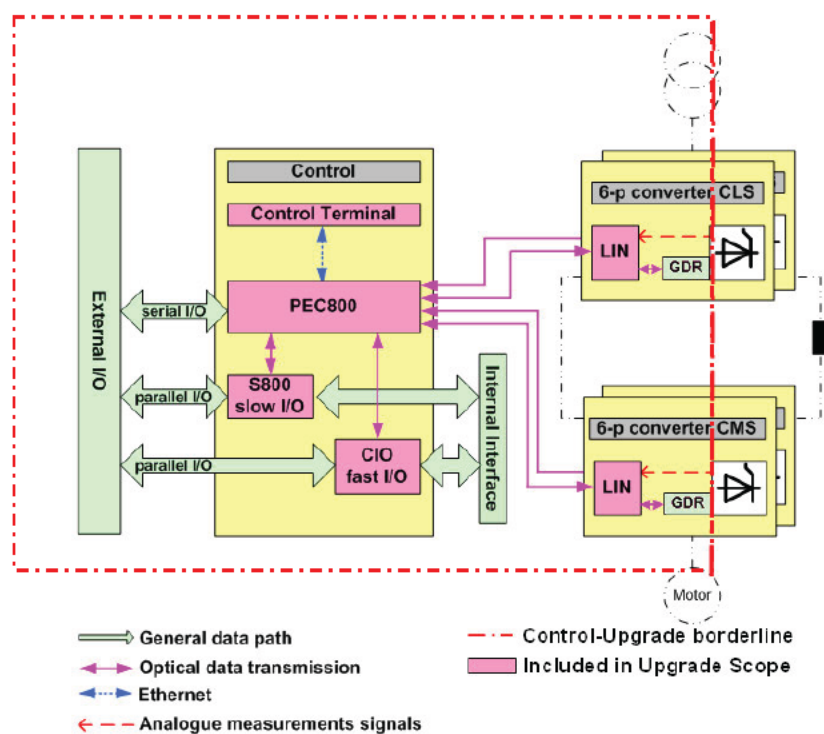
3.2 Key parts of a Converter

In the picture below an example of an air-cooled MEGADRIE-LCI is shown. The main parts of a converter are marked with colored lines.



6.3 Control topology of the MEGADRIE-LCI with AC 800PEC

The picture below gives an overview of the control platform with AC 800PEC and its main components. The control upgrade covers all the signal handling up to the thyristor.



6.4 AC 800PEC Controller

a) AC 800PEC controller

Because of the controller high computing capacity, all control, regulation, monitoring and protection functions can be performed by a single processing unit, using a function block programming language.

- The advantage of the excellent communication facilities for the user are:
- extreme flexibility when loading the user program and loading and viewing data and parameters
- high reliability through extensive self-monitoring
- comprehensive diagnostic and testing facilities for effective user support when testing and commissioning plants.

b) Simple to operate

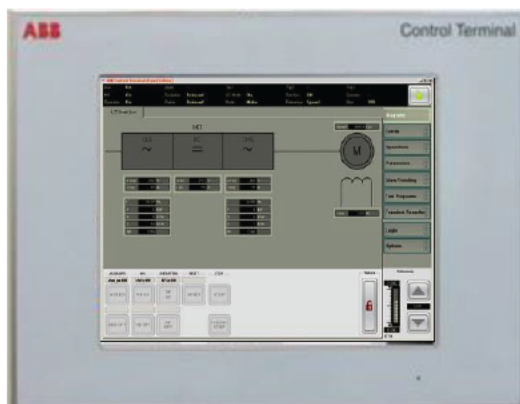
The LCI control terminal is used to control the system, view actual operating values and to annunciate failures.

c) Simple to integrate in superimposed control systems

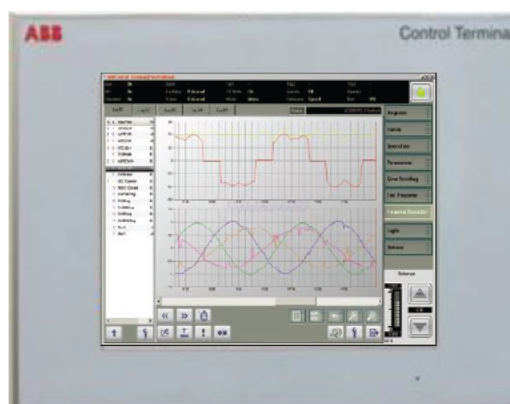
The input and output modules which are located as closely as possible to the process vicinity translate the process signals into system-conform signals.

6.5 User interface

After the upgrade, the user interface for the operator will be the MEGADRIVE-LCI Control Terminal, which is used for monitoring and controlling.



**System
Overview**



**Transient
Recorders**

6.6 Customer interface

The customer interface remains as it is today, only if there will be special requested modifications from the customer, it will be modified.

3.7 Controller software

The software is updated to the newest version of the MEGADRIVE-LCI application software. Standard SW tools, like ABB Control builder can be used.

7 Detailed Concept

7.1 Control Section

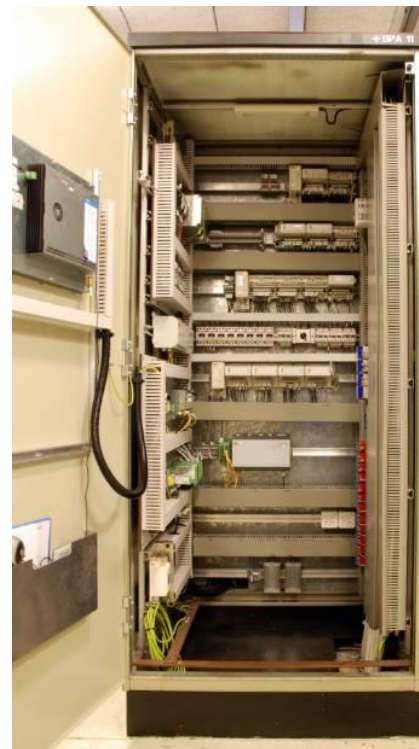
The swing frame is removed. The new control components are mounted inside the control cubicle as pre-manufactured installation plates. Field in-/output modules (S800) will be mounted on the side of the cubicle. The door of the control cubicle will be replaced by a new one that will have installed the LCI panel.

The following components will be replaced (with pre-assembled modules):

- PSR Control Rack
- Digital and Analogue input and output cards, including transducers
- DC-Power supplies (Control, LEM, Water cooling unit)
- Panel and single line diagram on the control cubicle door and emergency button



Example of an old control cubicle

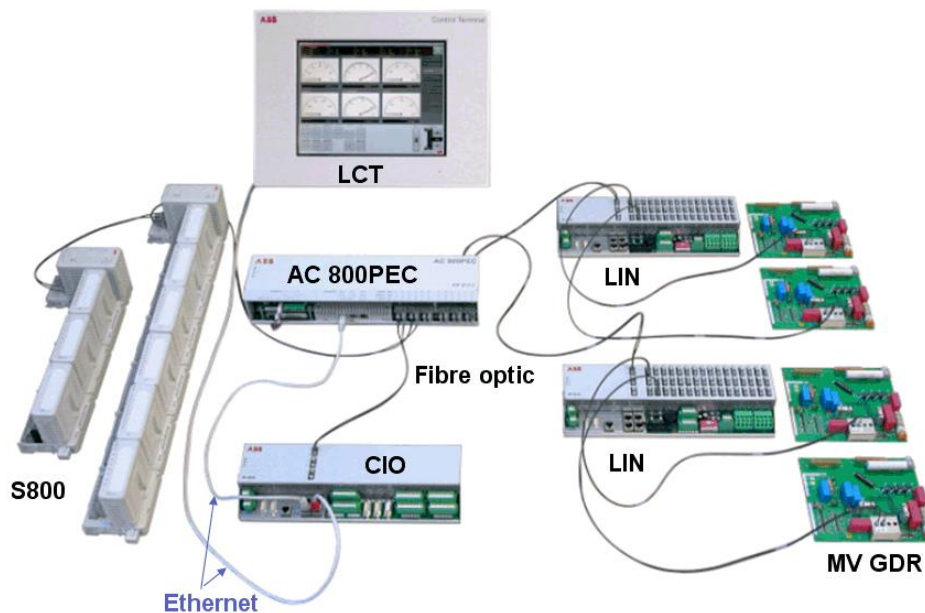


Example of a new control cubicle

7.2 Replacement of the PSR control platform

The existing PSR control mounted in the swing frame will be completely removed. All new control boards of the AC 800PEC control topology will be installed in the cubicle. These mainly are:

- AC800 PEC Application and Motor Control board
- Power Supply New power supplies and distribution is installed
- CIO Combined Input Output Module (Fast I/O)
- S800 Modules Slow input/output are handled with the ABB S800 modules
- LCT LCI Control Terminal will be installed on the door

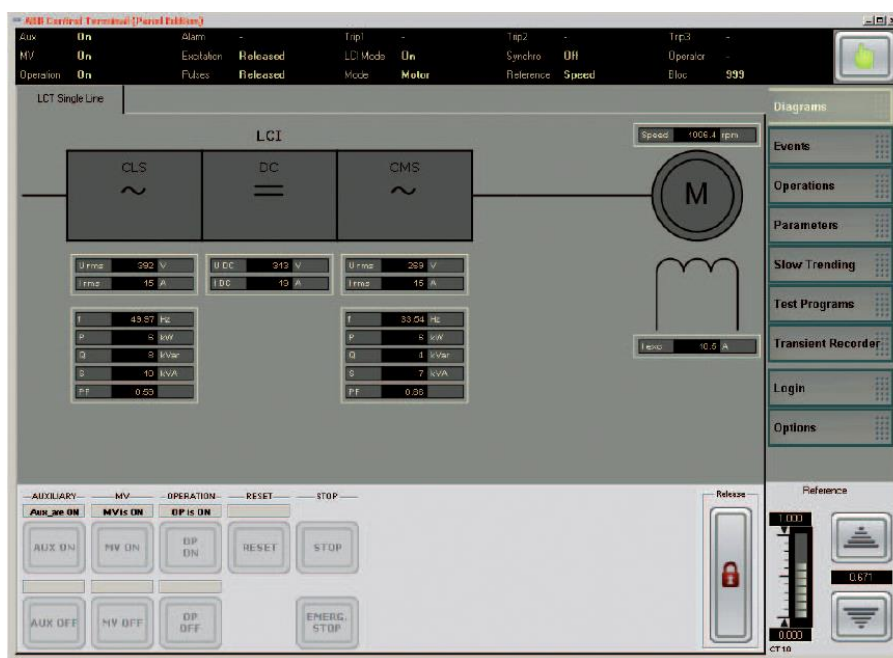


7.3 LCI Control Terminal

The new LCI Control Terminal is the user interface for the MEGADRIVE-LCI. All relevant information can be found and controlled via this 15" PC Panel.

Diagram (system overview)

- Easy and quick system overview
- Actual values such as line and motor voltage, current, power, power factor, frequency etc.
- Configurable control buttons



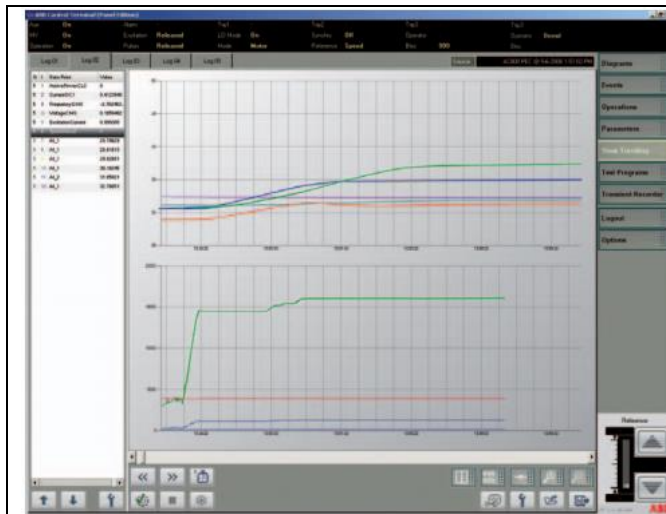
Static screen elements

The following information is always visible, independent of the selected screen:

- System status
- Indication of present access level
- Menu bar for screen selection
- Control/indication of actual set-point

- Six selectable signals displayed as analog instruments
- Configurable control buttons

- o Start and trip recorders register pre-selected signals of every start (10 ms sampling rate) and trip (1 ms sampling rate) automatically or manually



Example of trending screen

Trending

- Trending of selectable signals (100 ms sampling rate) with
- continuous recording
- Saving and re-loading of trending

7.4 Customer signal interface

In the standard control upgrade, the customer signal interface remains as it is today. However, on customer request, modifications can be implemented.

7.5 Controller software

The software is based on the newest available version of the MEGADRIVE-LCI and adapted to the existing application. This means that sequences and signal handling will be the same way as in the existing system. All the future control upgrades executed by ABB, will have the latest version of the software and the latest version, will be installed in the previously upgraded units.

7.6 Motor Auxiliary Control

The control and supervision of the motor auxiliary systems, such as pumps or temperature sensors, is done the same way as in the existing system.

7.7 Low voltage distribution

All miniature circuit breaker of the LV distribution as well as all the contactors will be installed on preassembled plates.

7.8 Start up Exciter.

In the start up exciter cubicle the same solution as in the active MEGADRIE-LCI will be used. Most elements remain unchanged. The control part will be exchanged completely. Start up exciter can be DC for brush or AC for brushless excitation.



Example of an original Excitation cubicle



Example of an upgraded Excitation cubicle

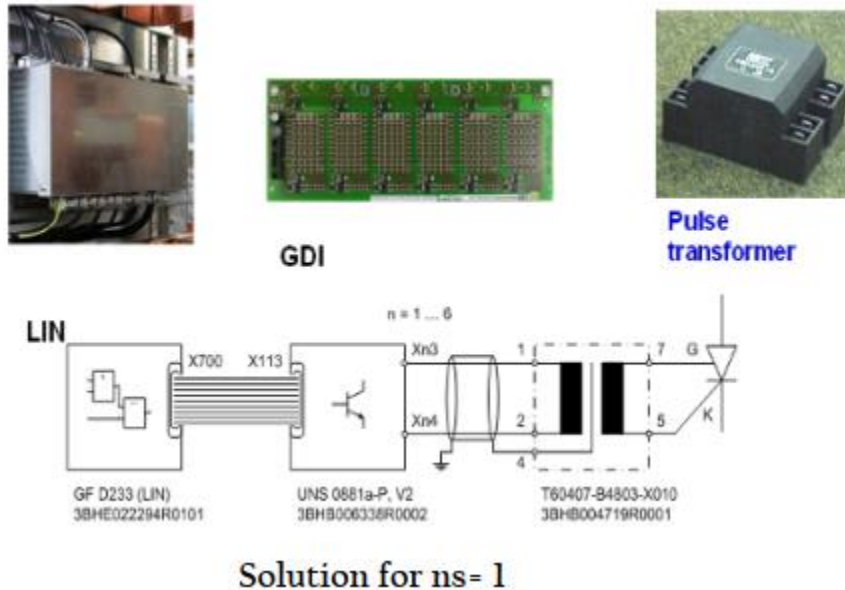
The following parts will be removed/replaced/installed:

- The existing excitation controller (i.e. Veritron) will be replaced by a DCS800 (same solution also used in ACS5000 and ACS6000)
- Excitation main contactor will be replaced with a new one
- The semiconductor fuses will be replaced if needed. The decision for the replacement of the fuses will be done after the site audit is executed

The following parts will remain:

- Existing transformers will remain

7.9 Single Thyristor Installed



The following parts will be replaced or installed:

- Impulse transformer (replaced)
- Fiber optics (installed)
- Secondary wiring of the potential transformers (PTs), current transformers (CTs) and mini circuit breakers (MCB) (installed)

The following parts remain:

- Thyristors
- Potential Transformer (PT) and Current Transformer (CT)
- Over voltage protection
- Bus bars
- R-L-C Attenuators
- Fuses

7.10 Cooling

There will be no modification of the air cooling during a control upgrade. If the site inspection shows that the fan should be replaced or bearings need to be replaced, this is considered to be part of the regular preventive maintenance program.

7.11 Documentation

It will include the mechanical drawings of the various modules as well as the electrical drawings with the cross-reference to the existing drawings.

Documentation
Hardware Diagram
Detailed Layout
Wiring List
Nameplate
Operating&Maintenance Manual
Assembly Drawing
Design Data
Factory Test Report
Commissioning Test Report

Note: Should the customer need any additional or specific documentation, they can be quoted separately. Please advise during the kick off meeting.

7.12 Test

At ABB's Factory

Testing will be performed at the ABB factory in Montreal, Canada. The customer will have the option of participating during the factory test (FAT) for one (1) day. Please note that all travel expenses will be covered by the customer. ABB shall send a copy of the testing report to the customer.

In general, the FAT tests include:

- Visual Inspection
- Voltage Insulation test
- Functional test of I/Os and submodules
- Checking the properties of the control equipment



- On Site

On site, the following tests will be done. Please note that this is a general testing procedure that will be modified or adapted to the particular installation at Sarnia Power Plant.

- Visual Inspection
- Ensure that ABB standard prerequisites for beginning of commissioning are fulfilled
- Load and functional test (the functionality of the interface is tested)
- Checking of auxiliary devices (fans, cooling system)
- Checking the properties of the control equipment
- Checking the protective devices (internal trips and alarms)

Factory routine test for a LCI Control Upgrade

8. Scope of Supply

8.1 In Scope

Control Cubicle

Control components

- AC 800PEC
- Power supply module
- Fast input and output signal module (FIO), including transducers
- Slow input and output signal module (S800), including transducers

Control cubicle door

- Panel
- Emergency OFF button

Low voltage distribution

- Mini circuit breakers
- Contactors and relays

Power Part

- Impulse transformer
- Fiber optics
- Secondary wiring of the potential transformers (PTs), current transformers (CTs) and the according mini circuit breakers (MCB)

Startup exciter

- Excitation controller (DCS800)
- Excitation main contactor

8.2 Out of Scope

The following equipment and services are not included in the control upgrade scope of supply and is therefore reused:

General

- Space heaters
- Door monitoring contacts
- Light and socket
- Thermostat and hygostat
- Terminals
- Cooling fan of the excitation cubicle



Control Cubicle

- Auxiliary transformer

Power Part

- Thyristors
- DC Reactor
- PT's; CT's
- LEM
- Capacitors
- Over voltage protection
- Snubber circuit
- Bus bars
- Fans for power part and DC Reactor
- MV-GRD's
- Over voltage protection (Optional)

Excitation Cubicle

- Semiconductor fuses
- Excitation transformer

Air cooling

- Fans
- Filter mats



9. Control Upgrade Process

The estimated engineering services detailed below are based on the average duration for similar past projects. Flights, travel days and sustenance are included for all services below.

If any, additional time (working time, waiting time, delays or trips to site are required to complete the work) will be billed as per the applicable ABB Standard Schedule of Rates for Excitation Systems & MEGADRIE LCI's of that year during which they are taking place. Site Audit, Installation, Installation Supervision & Commissioning are included in this quote.

9.1 Site Engineering

In order to ensure that the technical scope of the control upgrade is confirmed, ABB will perform a site audit to inspect the equipment. The site audit will be done during the same trip for the UNM control upgrade visit.

The activities to be performed are the following:

- Perform a complete visual inspection of the drive (feeder breaker, transformer, converter, DC-Reactor and motor)
- Validate site specific information (location of the drive, accessibility, lifting equipment, shutdown time, drawings, etc)
- Identify additional site drawings required.
- Check the dimensions where the installation plates are going to be mounted
- Compare schematics with actual installation to identify any deviation
- Validate cable/wiring list and connection points on site.
- Verify the openings and routing to bring equipment in place.

After the site audit is complete, ABB will provide a report with the findings and recommendations. Please keep in mind that if during the site audit any components of the power section need to be maintained or replaced, the customer will be informed.

9.2 Manufacturing Process

Pre-assembling and testing will be done in ABB's factory to shorten the on-site working time. Some components will be mounted on plates/swing frames to expedite, as much as possible, installation and commissioning time. The main objective is to execute the project within the allotted time.



9.3 Site Services

Site Removal and Installation

The scope of work includes removal of the old components from the Megadrive-LCI control cubicle and installation of the new components within the cabinet. Disposal of the old components will be under customer's responsibility

ABB will provide:

- One (1) Installation Technician
- One (1) Engineer for On-Site Installation supervision

The estimates will be based on the following approximations: eight (8) 10-hour days for installation. These estimates are based on work being completed Monday to Sunday.

Commissioning & SAT

Using ABB Standard Test Procedure, the scope of work includes mechanical & electrical inspection, high voltage test, functional test of the crowbar & protection devices, test of control functions, digital input & output programming, analog input & output programming, function test of the regulator, excitation monitoring & protection

ABB will provide:

- One (1) Engineer for Commissioning & SAT. (right after commissioning and during same trip)

Commissioning estimates are approximately seven (7) 10-hour days, based on work being completed Monday to Sunday. Any additional time shall be charged as per ABB Standard Service rates. Please refer to Annex 1.

10 Commercial Section

10.1 Equipment and on-site services

DESCRIPTION	PRICE (USD)
UNITROL M Excitation System Control upgrade for Units 2-3	
Equipment and on-site services:	
<ul style="list-style-type: none"> • Engineering • Equipment • Project management • Shipping DDP to site • Removal/Installation/Installation supervision • Commissioning 	Included
Synchrotact upgrade Units 2-3	Included
LCI Control upgrade blocks #262 & 263	
Equipment and on-site services:	
<ul style="list-style-type: none"> • Engineering • Equipment • Project management • Shipping DDP to site • Site engineering for the LCI and the exciters • Removal/Installation/Installation supervision • Commissioning 	Included
UN6080 training during the same trip as Commissioning	
<ul style="list-style-type: none"> • Class size of four (4) people maximum. • Three (3) days operation and maintenance training refer to Addendum F for course outline 	Included
LCI training during the same trip as Commissioning	
<ul style="list-style-type: none"> • Four (4) days operation and maintenance training refer to Addendum F for course outline. • Class size of four (4) people maximum. 	Included
TOTAL:	\$985,000.00

10.2 Optional Item

Overvoltage protection LCI 2.6/1.71 GT13D upgrade	
Quantity: 4. (2 per each LCI)	\$58,000.00
PN: 3BHB035574R002	



11 Terms & Conditions

Price Policy

Budgetary in USD funds, applicable sale taxes not included.

Shipping

DDP Site, Incoterms 2010. Offloading done by Customer.

Warranty

The control section of the Excitation System will be warranted for twelve (12) months from commissioning or eighteen (18) months from delivery, whichever comes first.

Delivery

7 to 9 months from order confirmation, if shorter delivery time is needed, please contact ABB.

Payment Terms (30 days Net, after receipt of each invoice)

30% upon PO receipt

50% Upon delivery first unit and no later than 7-9 months after PO.

20% upon completion of commissioning or 60 days after delivery

Proposal Validity

This ABB budgetary offer is preliminary and not final and as such non-binding. It is tendered for discussion only, does not constitute an offer to sell and /or term to contract and ABB can, without notice, make any change in ABB own discretion. Any contract to sell the subject matter of the proposal shall be subject to prior mutual agreement as to price (which may be different than shown herein), schedule, scope of work and terms.

Standard Corporate Terms and Conditions

ABB Standard Terms and Conditions (see following pages).

Credit Policy

Any order received by the Seller is subject to credit approval and may be cancelled if the Purchaser's credit standing is not satisfactory to Seller. Please note that if this proposal meets your request, please submit your purchase order referencing this proposal number EXCS-19-92 to:

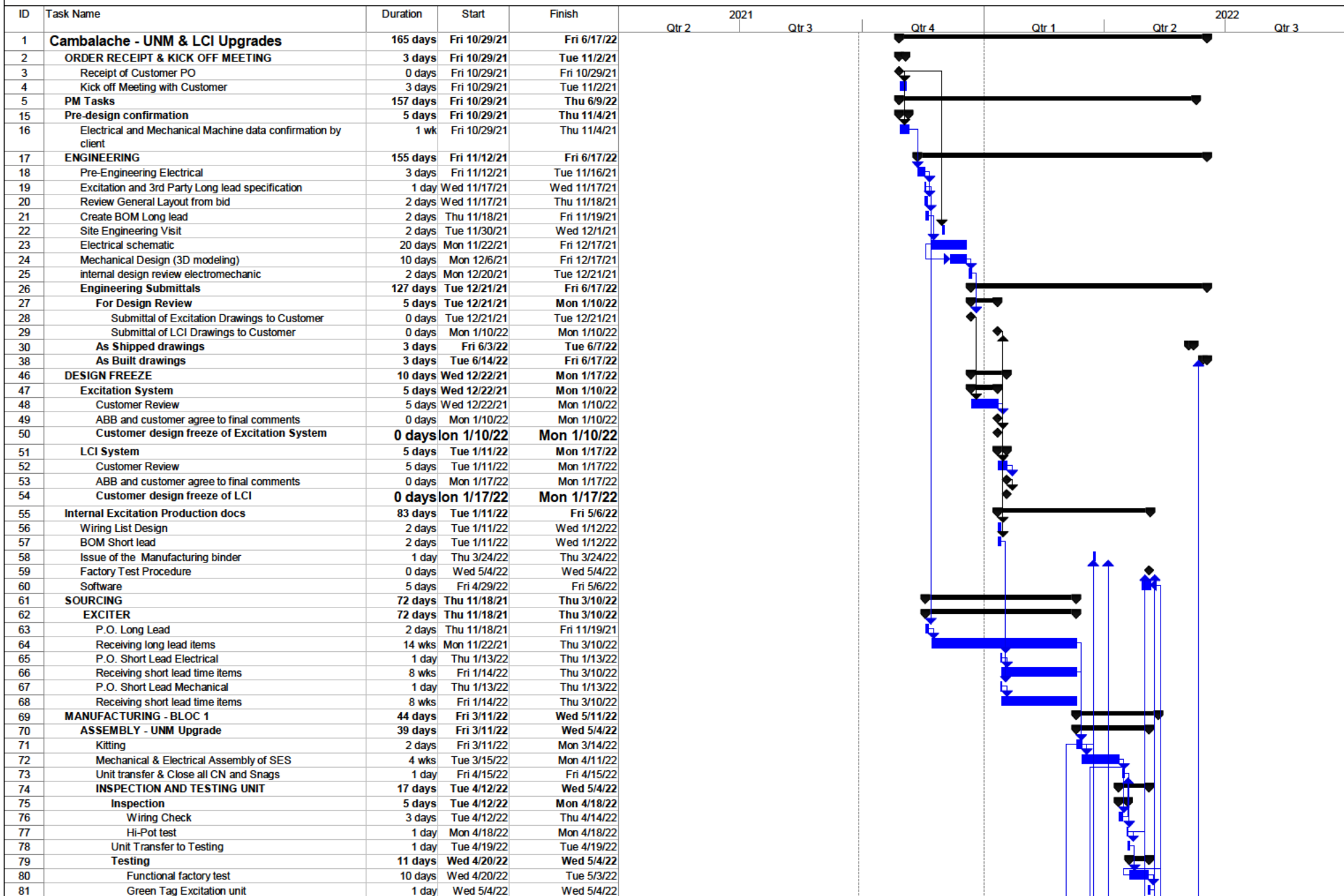
ABB Inc.

23000 Harvard Road

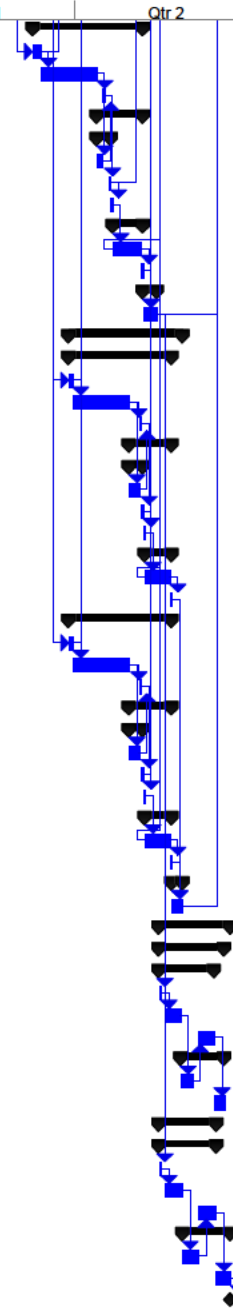
Cleveland, Ohio

Tel. +1 (514) 3865092

Email: javier.mujica@ca.abb.com



ID	Task Name	Duration	Start	Finish	2021			2022		
					Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3
82	ASSEMBLY - LCI Upgrade	39 days	Fri 3/11/22	Wed 5/4/22						
83	Kitting	2 days	Fri 3/11/22	Mon 3/14/22						
84	Mechanical & Electrical Assembly of SES	4 wks	Tue 3/15/22	Mon 4/11/22						
85	Unit transfer & Close all CN and Snags	1 day	Fri 4/15/22	Fri 4/15/22						
86	INSPECTION AND TESTING UNIT	17 days	Tue 4/12/22	Wed 5/4/22						
87	Inspection	5 days	Tue 4/12/22	Mon 4/18/22						
88	Wiring Check	3 days	Tue 4/12/22	Thu 4/14/22						
89	Hi-Pot test	1 day	Mon 4/18/22	Mon 4/18/22						
90	Unit Transfer to Testing	1 day	Tue 4/19/22	Tue 4/19/22						
91	Testing	11 days	Wed 4/20/22	Wed 5/4/22						
92	Functional factory test	10 days	Wed 4/20/22	Tue 5/3/22						
93	Green Tag LCI unit	1 day	Wed 5/4/22	Wed 5/4/22						
94	SHIPPING UNITS - BLOC 1 (UNM+LCI Upgrades)	5 days	Thu 5/5/22	Wed 5/11/22						
95	Shipping to Customer Upgrades	5 days	Thu 5/5/22	Wed 5/11/22						
96	MANUFACTURING - BLOC 2	44 days	Tue 3/29/22	Tue 5/24/22						
97	ASSEMBLY - UNM Upgrade	39 days	Tue 3/29/22	Thu 5/19/22						
98	Kitting	2 days	Tue 3/29/22	Wed 3/30/22						
99	Mechanical & Electrical Assembly of SES	4 wks	Thu 3/31/22	Wed 4/27/22						
100	Unit transfer & Close all CN and Snags	1 day	Tue 5/3/22	Tue 5/3/22						
101	INSPECTION AND TESTING UNIT	17 days	Thu 4/28/22	Thu 5/19/22						
102	Inspection	5 days	Thu 4/28/22	Wed 5/4/22						
103	Wiring Check	3 days	Thu 4/28/22	Mon 5/2/22						
104	Hi-Pot test	1 day	Wed 5/4/22	Wed 5/4/22						
105	Unit Transfer to Testing	1 day	Thu 5/5/22	Thu 5/5/22						
106	Testing	11 days	Fri 5/6/22	Thu 5/19/22						
107	Functional factory test	10 days	Fri 5/6/22	Wed 5/18/22						
108	Green Tag Excitation unit	1 day	Wed 5/18/22	Thu 5/19/22						
109	ASSEMBLY - LCI Upgrade	39 days	Tue 3/29/22	Thu 5/19/22						
110	Kitting	2 days	Tue 3/29/22	Wed 3/30/22						
111	Mechanical & Electrical Assembly of SES	4 wks	Thu 3/31/22	Wed 4/27/22						
112	Unit transfer & Close all CN and Snags	1 day	Tue 5/3/22	Tue 5/3/22						
113	INSPECTION AND TESTING UNIT	17 days	Thu 4/28/22	Thu 5/19/22						
114	Inspection	5 days	Thu 4/28/22	Wed 5/4/22						
115	Wiring Check	3 days	Thu 4/28/22	Mon 5/2/22						
116	Hi-Pot test	1 day	Wed 5/4/22	Wed 5/4/22						
117	Unit Transfer to Testing	1 day	Thu 5/5/22	Thu 5/5/22						
118	Testing	11 days	Fri 5/6/22	Thu 5/19/22						
119	Functional factory test	10 days	Fri 5/6/22	Wed 5/18/22						
120	Green Tag LCI unit	1 day	Wed 5/18/22	Thu 5/19/22						
121	SHIPPING UNITS - BLOC 2 (UNM+LCI Upgrades)	5 days	Thu 5/19/22	Tue 5/24/22						
122	Shipping to Customer Upgrades	5 days	Thu 5/19/22	Tue 5/24/22						
123	INSTALLATION & COMMISSIONING SCHEDULE	34 days	Fri 5/13/22	Fri 6/17/22						
124	UNM Upgrade	31 days	Fri 5/13/22	Tue 6/14/22						
125	INSTALLATION OF UNITS - UNM Upgrade	26 days	Fri 5/13/22	Thu 6/9/22						
126	Site mobilization	1 day	Fri 5/13/22	Fri 5/13/22						
127	Installation Unit 1	8 edays	Sun 5/15/22	Mon 5/23/22						
128	Installation Unit 2	8 edays	Wed 6/1/22	Thu 6/9/22						
129	COMMISSIONING AND START UP OF UNITS (UNM)	20.75 days	Mon 5/23/22	Tue 6/14/22						
130	Commissioning UNM Upgrade - Unit 1	5 days	Mon 5/23/22	Sun 5/29/22						
131	Commissioning UNM Upgrade - Unit 2	5 days	Thu 6/9/22	Tue 6/14/22						
132	LCI Upgrade	27 days	Fri 5/13/22	Fri 6/10/22						
133	INSTALLATION OF UNITS - LCI Upgrade	27 days	Fri 5/13/22	Fri 6/10/22						
134	Site mobilization	1 day	Fri 5/13/22	Fri 5/13/22						
135	Installation Unit 1	9 edays	Sun 5/15/22	Tue 5/24/22						
136	Installation Unit 2	9 edays	Wed 6/1/22	Fri 6/10/22						
137	COMMISSIONING AND START UP OF UNITS (LCI)	22.75 days	Tue 5/24/22	Fri 6/17/22						
138	Commissioning UNM Upgrade - Unit 1	7 days	Tue 5/24/22	Wed 6/1/22						
139	Commissioning UNM Upgrade - Unit 2	7 days	Fri 6/10/22	Fri 6/17/22						
140	COMMERCIAL OPERATION	0 days	Fri 6/17/22	Fri 6/17/22						



Addendum

Addendum A MOD26 / PRC Study and Tuning details

Price for NERC MOD26 / PRC Study and Tuning is available upon request.

The PSS software is embedded in the new controls that ABB will provide.

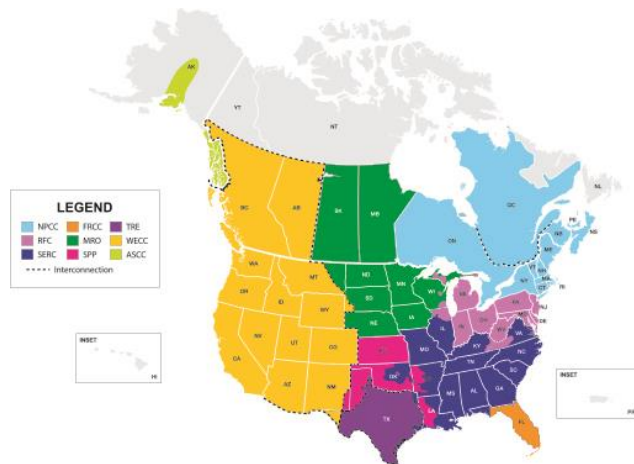


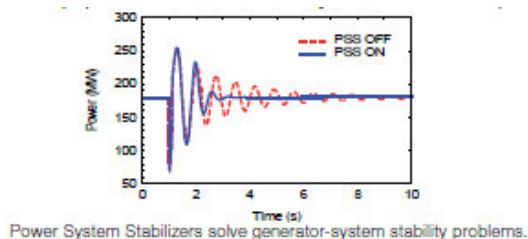
ABB has the expertise to help you meet your NERC and Regional reporting requirements as well as your transient and small-signal stability objectives.

ABB can perform a PSS study and tuning for each unit if it is required, ABB will quote accordingly.

We have found that one of the most misunderstood pieces of power plant equipment is the Power System Stabilizer (PSS).

Since most utilities may not have the expertise or personnel to address stability issues, we offer the following services:

On-site PSS Tuning and Testing:
Selected settings are implemented on your new system and fine-tuned through testing to ensure optimal performance.



EXCITATION SYSTEMS

UNITROL® Excitation Control Terminal

Empowering operation, control and maintenance



The UNITROL Excitation Control Terminal (ECT) is used for the monitoring and controlling of UNITROL excitation systems. It can be located at the excitation system as a door panel for local control and/or in the central control room for remote operation.

01 Front view of the ECT showing the power chart screen

The ECT is a powerful industrial PC with a human machine interface (HMI) that runs independently from the system's computer processing units (CPUs). It can be provided with UNITROL excitation systems or can be added at a later stage. The LCD touch screen provides the operator with a range of selectable screens for interactive excitation control. The current system status is displayed in graphical and numerical form. Key data is always visible on the system status bar.

The device is supplied with powerful analytical tools that support troubleshooting. For important data, ECT provides long-time recordings and auto-save functions on its internal memory. These data can be displayed or downloaded for further investigation. ECT software can also be installed on any PC with Windows® 10 operating system.

Operational Features

- Independent industrial PC with 12" or 15" color touch screen
- TCP communication
- Password protected access levels
- Selectable languages

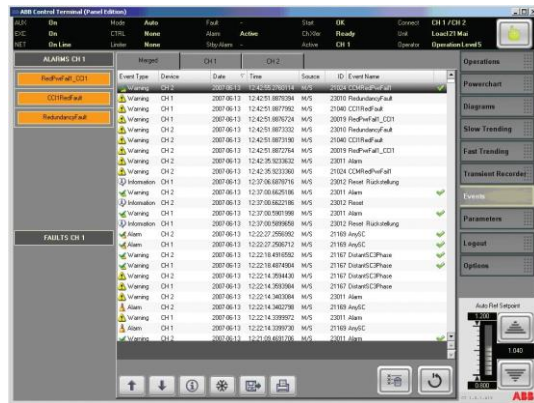
System status bar

- The following information is always visible, independent of the selected screen:
- System status
- Indication of present access level
- Menu bar for screen selection
- Control/indication of actual set-point

Power Chart

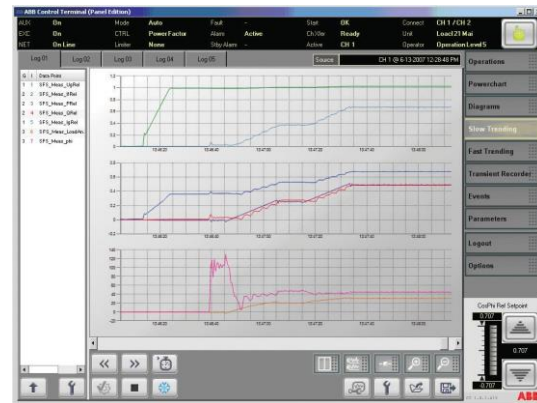
- Capability curve of the machine
- Setting characteristics of all limiters
- Actual machine current vector
- One-hour history of the operating point

Examples of available screens



Events screen

- Indication of pending faults and alarms in each channel and log list
- Event description with troubleshooting instructions in major languages
- Saving and re-loading of event list
- Print and export function



Trending screen

- Up to 12 selectable signals
- Trending (2.5 ms - 1 s sampling rate) with long-time recording (up to 24 h)
- Saving and re-loading of trending
- Auto scaling / zoom and single channel indication



Operations screen

- Six selectable signals displayed as analog instruments providing full machine instrumentation
- Configurable command buttons for system control

Data logger

- Easy handling of recorded data
- Auto-save and reset function

Parameters

- Reading and setting of parameters
- Description of major parameters in selected languages
- Parameter selection / user defined table
- Parameter export and import function

Addendum C UNITROL 6080 Operation and Maintenance training

COURSE DESCRIPTION

CA684 Excitation Systems

UNITROL® 6080 Operation & Maintenance training



Well-trained and knowledgeable employees are the most valuable assets for any successful organization.

Duration

- 3 days

Description

The course goal is to teach students to operate, maintain and troubleshoot the UNITROL 6080 Excitation System.

Learning Objectives

Upon completion of this course, the participants will be able to:

- Operate the UNITROL 6080 Excitation System
- Perform standard maintenance
- Trace and correct faults

Participants

(maximum of 8)

- Operating personnel
- Maintenance personnel

Prerequisites

- Basic electrical knowledge
- Basic knowledge of power generation
- Computer knowledge is recommended

Topics

- Synchronous machine basics
- Duties of the Excitation System
- Configurations of the UNITROL 6080 with its redundancy principle
- Principle operation of the hardware
 - Main Controller
 - Measuring and I/O interfaces
 - HMI and communications
 - Excitation Control Terminal (ECT)
 - Service Control Panel (SCP)
 - Power Converter
- Principle operation of the software
 - Voltage regulator with limiters and power system stabilizer
 - Channel and follow-up control
 - Monitor and protect
 - Superimposed $\cos \phi$ / VAR control
 - Ethernet addressing and communication to upper control systems
- How to use the UNITROL 6080 tools for maintenance
 - PEC Installer tool
 - Excitation Control Terminal (ECT)
- How to use the Local Excitation Control Terminal (ECT) or the Service Control Panel (SCP)
 - Operate the excitation system locally
 - Verify the operating point of the synchronous machine
 - Displaying signals on the panel
 - Use the trending and transient recorder
 - Read the event/alarm logger
 - Identify and interpret alarm indication

COURSE DESCRIPTION

CA684 Excitation Systems

UNITROL® 6080 Operation & Maintenance training

Day 1	Day 2	Day 3
<p>Welcome</p> <p>Introductions</p> <p>Excitation System basics</p> <ul style="list-style-type: none"> • Behavior of the synchronous machine • Duties of the excitation system <p>UNITROL 6080 system introduction</p> <ul style="list-style-type: none"> • System architecture, topology • System layout • Software functions 	<p>Hardware concept of the UNITROL 6080</p> <ul style="list-style-type: none"> • Hardware configuration of UNITROL 6080 • Connections and Interfacing • Indication and setting <p>Power converters used by the UNITROL 6080</p> <ul style="list-style-type: none"> • Principle of operation • Power converter types and ratings • Cooling system • Maintenance aspects <p>How to read the electrical schematic</p> <p>Introduction to the software</p> <ul style="list-style-type: none"> • TCP/IP addresses • Upload/download the application software using the PEC Installer <p>Exercises with the table model</p>	<p>How to use the Excitation Control Terminal (ECT)</p> <p>Log in</p> <p>ECT status verification</p> <p>Operate the excitation system from the ECT</p> <p>Fault loggers uploads</p> <p>Alarms and faults reset</p> <p>How to use the Service Control Panel (SCP)</p> <p>Preventive maintenance work</p> <p>Recommended maintenance schedule</p> <p>Maintenance tasks</p> <p>Functional tests</p> <p>Troubleshooting aspects</p> <p>Safety aspects</p> <p>Troubleshooting methods</p> <p>Monitoring and protection functions</p> <p>Verification of the root cause of the problem</p> <p>Identify and replace defective components</p> <p>Replace the thyristor</p> <p>Course conclusion/ feedback</p>

Customer support: on-demand service rates

2021 Standard rate schedule for Excitation Systems (UNITROL) and Static Starters (MEGADRIVE-LCI)

SAFETY FIRST! For safety purposes, ABB reserves the right to limit continuous work of one individual to 12 hours with a minimum of 8 hours of rest in a hotel prior to starting again.

SERVICE DESCRIPTION	APPLICABLE STANDARD RATE	RATE TERMS	MULTIPLIER
Excitation field engineer	\$260/hour	Regular	1.00 x Standard rate
LCI field engineer	\$282/hour	Overtime 1	1.50 x Standard rate
		Overtime 2	2.00 x Standard rate
		Night shift overtime	1.20 x Applicable standard rate

	WEEKDAYS (MONDAY TO FRIDAY)	SATURDAY	SUNDAY AND HOLIDAYS
DAY SHIFT 6:00 – 20:00	Standard rate: First consecutive 8 hours Overtime 1 rate: After 8 and less than 12 hours Overtime 2 rate: Greater than 12 hours	Overtime 1 rate: First consecutive 8 hours Overtime 2 rate: Greater than 8 hours	Overtime 2 rate: Any hours
NIGHT SHIFT ¹ 20:00 – 6:00	Night shift rate: First consecutive 8 hours Overtime 1 rate: After 8 hours	Overtime 2 rate: Any hours	Overtime 2 rate: Any hours

TRAVEL AND OTHER COSTS	
Travel and living expenses hotel, car rental, airfare, taxi, etc.	Cost + 10 % administration fee
Meal allowance	Per diem: \$ 75/day
Car allowance when applicable	\$ 0.72/km – minimum charge of \$ 75/day
Tools, equipment rental and consumables	Cost + 10 % administration fee + 15 % markup
Emergency Call-out fee (Less than 48 hrs)	\$ 3,275 ²

DEFINITIONS AND CONDITIONS

Cancellation All services must be scheduled and confirmed at least five (5) business days prior to travel. In the event of any cancellations in less than five (5) business days to travel, all incurred expenses and an 8 hour cancellation fee will be charged at the applicable rate.

Travel Time Travel time is charged at applicable standard hourly rates.

Office Support time (on demand) Office support (including project coordination) time is charged at applicable standard hourly rates.

Standby Standby time is charged at applicable standard hourly rates. Minimum billing of 8 hours per day at applicable hourly rate for all services provided, including standby during weekdays and weekends.

Premiums Danger pay based on regional risk, daily hardship premiums, out-of-country assignment, in-country remote area allowances, and daily offshore premiums will be applicable following ABB policies and standards.

All the above prices are in USD currency and do not include federal, state/provincial, local or any other taxes (where applicable) and are subject to changes at anytime without further notice. All services are performed under ABB Inc. Terms and Conditions of Sale.

Excitation Care Agreements We can provide a full spectrum of services customized for your site on a contract basis. For more information, contact us at CA-excitation@abb.com.

24/7/365 Technical Phone Support +1 (800) HELP 365

¹ Night shift rates apply to any hours worked from 20:00 — 6:00

² The Emergency Call-Out Fee is waived for customers with valid Excitation Care Agreement.

TERMS AND CONDITIONS OF SALE

1. ACCEPTANCE OF CONDITIONS

Upon the occurrence of any of the following events, Purchaser, as identified in the order (the "Purchaser"), shall, be deemed to have unconditionally accepted ABB Inc.'s (the "Seller") terms and conditions: (a) acknowledgement of an order; (b) upon receipt in whole or in part of the shipment sold under an order; or (c) upon payment in whole or in part of the equipment, goods, products, and workmanship related thereof, and the license of software, or related materials supplied hereunder, ("Equipment") or performance of services ("Services") or both. Any deletions, modifications or additions made to Seller's terms and conditions, shall not be binding unless they are expressed in writing and signed by both Seller and Purchaser's authorized representatives. The price has been established by Seller and agreed by the Parties on the basis of Seller's terms and conditions. In no event shall Purchaser's terms, if any, apply to this order, and the Parties hereby disclaim and reject the application of any such terms.

2. DELIVERY

2.1 Unless otherwise agreed in the purchase order by the Parties, Equipment sold hereunder shall be delivered Ex Works, Seller's factory, as per Incoterms 2010. Delivery dates specified in any quote are approximate, unless specified as firm and binding. Delivery performance is dependent upon prompt receipt from Purchaser of all specifications, final approved drawings and any other details essential to the proper execution of Purchaser's order.

2.2 Upon notification of readiness of Equipment by Seller to Purchaser, Purchaser shall promptly take delivery of the Equipment. Any delay by Purchaser to take delivery of the Equipment shall result in Purchaser paying storage, maintenance and associated charges, and Seller shall invoice Purchaser as if shipment or other performance had been made as originally scheduled. Such storage, handling maintenance shall be performed at Purchaser's cost and risk. Failure of Purchaser to take prompt delivery shall result in payment terms tied to such delivery becoming due immediately and payable. The warranty period, hereinafter defined, will begin upon such notification of readiness.

2.3 Unless otherwise agreed upon between the Parties, Purchaser shall have the sole responsibility of choosing the carrier and routing from Seller's manufacturing facilities to the final destination.

3. FORCE MAJEURE

Seller shall not be liable for delays in the execution of its obligations due to causes beyond its reasonable control including but not limited to acts of God, fires, strikes, labour disturbances, floods, epidemics, quarantine restrictions, war, insurrection or riot, acts of government or public authority, freight embargoes, car shortages, wrecks and unusually severe weather. In the event of any such delay, the date of shipment will be extended to account for the entire delay resulting from such cause (including any demobilization or remobilization) but in no event less than the actual duration of the delay.

4. WARRANTIES

Equipment

4.1 Seller warrants that during the warranty period hereinafter defined the Equipment sold shall be free from defects in material and workmanship and shall be of the kind and quality designated or described in Seller's specifications.

4.2 If within eighteen (18) months from the date of notification of readiness of shipment or twelve (12) months from date of first use by Purchaser or the end user, whichever date occurs first, the Equipment does not meet the warranties specified above, Seller agrees to correct any defect, at its option, either by repairing any defective parts, or by making available Ex Works, repaired or replacement parts, provided Purchaser notifies Seller promptly of any such defects within the aforesaid period.

4.3 The cost of removal of and access to the defective Equipment from its related system, site and/or ancillary equipment, and the cost of its reinstallation in such system, site and/or ancillary equipment, including all transportation costs to and from Seller's plant or repair shop, shall be borne exclusively by Purchaser. Purchaser shall not return or dispose of any Equipment or part thereof with respect to which it intends to make a claim under the foregoing warranty, without Seller's express prior written authorization.

Software

4.4 Seller warrants that it shall repair or replace, at its option and Ex Works Seller's factory, software products which fail in manner which significantly and adversely affects operating performance to conform to Seller's published software product description applicable to the specific software version as delivered to Purchaser, provided Seller receives written notification of any such failure to conform within thirty (30) days from the readiness of shipment software. Seller does not warrant that the functions contained in the software will operate in combinations which may be selected for use by Purchaser, or that the software products are free from errors.

Services

4.5 Where Seller supplies Services, Seller warrants that it shall re-perform Services which are found to have been performed other than in a professional manner and in accordance with sound, generally accepted and professional practices in effect at the time of performance, provided Seller receives written notification of the defect as soon as reasonably possible, but no later than within ninety (90) days from the date of such performance.

4.6 Notwithstanding anything to the contrary in these terms, relating to Seller's supervision, recommendations and advice (collectively, "Advice") on work performed by Purchaser, its subcontractors or agents (collectively, "Purchaser's Work"), Purchaser acknowledges, covenants and agrees that:

4.6.1 Although Seller may provide Advice in connection with Purchaser's Work in order to assist it in Purchaser's management and supervisory functions and in making decisions in connection with Purchaser's Work, Purchaser's duties and responsibilities, Seller's Advice excludes any management or supervisory responsibility in connection with such Purchaser's Work and Seller shall not assume any responsibility or liability for such Purchaser's Work, its use, implementation, output and fitness for purpose, nor for the operation of Purchaser's equipment, which responsibility shall remain entirely with Purchaser;

4.6.2 The Advice may indicate areas of risk and the means by which such risks may be mitigated. It is not possible to guarantee or warrant the outcome of such risk mitigation;

4.6.3 Purchaser is responsible for determining whether the Advice are appropriate for Purchaser's stated or intended purposes and it is the sole responsibility of Purchaser to decide whether and how such Advice may be implemented;

4.6.4 Purchaser shall assign qualified persons to perform such Purchaser's Work;

4.6.5 Purchaser retains at all times care, custody and control of Purchaser's Work and must ensure appropriate security and supervision thereof;

4.6.6 Any Advice are specific to given circumstances, and Purchaser shall seek new Advice from, or enquire with, Seller if Purchaser's Work is delayed, is to be repeated or if seemingly similar work is to be undertaken.

Nothing in these terms and conditions is or shall be deemed to be a warranty provided by Seller to Purchaser in respect of any Advice provided in connection with Purchaser's Work or that of any third party, including the adequacy, correctness or sufficiency of any such work, and all warranties are hereby

- expressly disclaimed in accordance with Section 4.8 below *mutatis mutandis*.
- Warranty Conditions**
- 4.7 Any repair, replacement or re-performance pursuant to the foregoing warranties pursuant hereto shall not renew or extend the warranties. The foregoing warranties shall be void to any deficiency or defect resulting from, the Equipment being improperly installed or cared for, operated under abnormal conditions or contrary to specifications or instructions of Seller, normal wear and tear, modifications or alterations made by Purchaser or a third party without Seller's consent.
- 4.8 THE EXPRESS WARRANTIES SET FORTH IN THIS SECTION ARE EXCLUSIVE AND NO OTHER WARRANTIES OF ANY KIND, WHETHER STATUTORY, ORAL, WRITTEN, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, SHALL APPLY. PURCHASER'S EXCLUSIVE REMEDIES AND SELLER'S ONLY OBLIGATIONS ARISING OUT OF OR IN CONNECTION WITH DEFECTIVE EQUIPMENT, SERVICES OR ADVICE (INCLUDING ANY LATENT DEFECTS), WHETHER BASED ON WARRANTY, CONTRACT, TORT (INCLUDING NEGLIGENCE) OR OTHERWISE, SHALL BE THOSE STATED HEREIN.
- 5. INSURANCE, CHARGES & PROPER CARE**
- So long as sums shall remain owing by Purchaser to Seller hereunder, Purchaser shall exercise proper care in the possession and use of the Equipment and shall keep same at all times in good repair and free of all liens, options, taxes, charges, pledges, privileges and encumbrances. Purchaser shall insure Equipment against loss, destruction or theft for the full value of the replacement purchase price of the Equipment.
- 6. TITLE & RISK**
- 6.1 The title to and property in the Equipment sold hereunder and any substitutions or additions thereto and the right to possession thereof, whether attached to realty or otherwise, shall pass from Seller to Purchaser when the full purchase price of the Equipment has been paid. Upon failure to make any payment as herein provided, the whole purchase price and any note or security given on account therefore shall forthwith become due and payable and Seller may immediately enter the premises where the Equipment is located and take possession of and remove the same as its personal property, and may retain any or all partial payments already received as a rental charge for the use of the Equipment without affecting any further or other claims which Seller may have against Purchaser.
- 6.2 Equipment sold hereunder shall be at Purchaser's risk on delivery to it as specified in Section 2 above, and the loss or destruction of all or part of said Equipment shall not release Purchaser from any obligations of payment hereunder.
- 7. LIMITATION OF LIABILITY**
- 7.1 Modifications or adjustments to Purchaser's processes or equipment which is made by Purchaser upon the good faith recommendations of Seller shall be made at Purchaser's risk. In no event shall Seller be liable for conditions of Purchaser's site.
- 7.2 The liability of Seller, its agents, directors, officers, employees, subcontractors, suppliers, for all claims, actions, judgements, expenses related to or resulting from any loss or damage arising out of performance or non-performance of obligations in connection with the design, manufacture, sale, delivery, storage, of the Equipment shall in no case exceed Seller's net unit price Ex Works of such Equipment or part thereof involved in a claim. Where Seller sells Services or provides Advice, in no event shall the liability of Seller, its agents, directors, officers, employees, subcontractors, suppliers for all claims, actions, judgment, expenses related to or resulting from any loss or damage arising out of performance or non-performance of Services or Advice, shall not exceed in the aggregate the amount paid by Purchaser to Seller for the Services or Advice performed under the order.
- 7.3 In no event shall Seller be liable for loss of profit or use and for any indirect, special, incidental or consequential damages of any nature or kind including but not limited to delays, loss of revenue, loss of use, loss of data, loss of production, costs of capital or costs of replacement power, even if Seller has been advised of the possibility of such damages.
- 7.4 The limitations set forth in this Section 7 shall apply and be effective with respect to any claim, cause of action, or legal theory whatsoever including, but not limited to, contract or warranty (including performance guarantees) or breach thereof, indemnity, tort (including negligence), strict liability.
- 8. PRICES & PAYMENT TERMS**
- 8.1 All prices/rates are valid thirty (30) days from date of quotation by Seller. Otherwise, prices are subject to change without notice.
- 8.2 All prices are Ex Works, Seller's factory, unless otherwise specified in writing by Seller. Prices quoted do not include federal, provincial, local or any other taxes, charges, levies and duties, and if same are applicable these shall be promptly paid by Purchaser.
- 8.3 All prices are in Canadian Dollars unless otherwise specified.
- 8.4 Payment shall be made direct to Seller's office in accordance with the conditions stated in the order. Unless otherwise specified, payment shall be due net thirty (30) days from the date of sending of the relevant invoice by Seller, and time is of the essence in Purchaser's execution of any payment hereunder. Purchaser shall be in default if it fails to pay the price or make any payment upon it becoming due, and Seller may terminate the order where Purchaser fails to cure such default within five (5) days of Seller's written notice. Any late payment shall bear interest at the rate set by Seller from time to time which is one and a half percent (1.5%) per month, eighteen percent per annum (18%), at the date of issue, calculated and due on a monthly basis.
- 8.5 Where Seller supplies Services or Advice, in the event of a request by Purchaser for additional specialist Services or Advice, the Services will be invoiced at the current per diem per person rate for those Services. Associated travel and living costs will be added to those invoices. For extended hours (beyond 8 hours/daily), the rate for specialist Services will change to an hourly rate person at one and a half (1.5) times the equivalent rate based on the per diem. Similarly, weekend and holiday requirements will be charged at two (2) times the hourly rate. Travel and lodging will be billed at actual cost plus a ten percent (10%) administration charge.
- 9. INTELLECTUAL PROPERTY INFRINGEMENT**
- Seller will, at Seller's expense, defend any suit which may be brought against Purchaser based on a claim that any Equipment or part furnished under contract constitutes an infringement of any letter patent or other intellectual property right registered in the United States of America or Canada (provided Seller is notified promptly of such suit and copies of all papers therein are promptly delivered to Seller) and Seller agrees to pay all judgments and costs recovered for any reasonable costs or expenses incurred in the defence of any such claim or suits. In case said Equipment or any part is held to constitute infringement and the use of the Equipment or part is enjoined, Seller shall, at its own expense, either procure for Purchaser the right to continue using the Equipment or part; or replace with non-infringing Equipment; or modify it so that it becomes non-infringing; or remove the Equipment and refund the purchase price and the transportation and installation costs thereof. The foregoing states the entire liability of Seller for such infringement by the Equipment or any part thereof. This provision shall not apply to any equipment or part which is manufactured by Seller or third parties, to Purchaser's design or specifications. Seller assumes no liability for any such infringement and Purchaser agrees to defend any suit against Seller for alleged infringement arising through the manufacture and sale of Equipment made to Purchaser's design or specifications and to indemnify and hold Seller harmless from any liability arising from any such infringement.
- 10. DAMAGES & LOSS CLAIMS**
- 10.1 Seller shall carefully pack all Equipment sold hereunder and Seller shall assume no responsibility for damage after having received "in good order" receipts from the carrier at Seller's works.
- 10.2 All claims for loss, damage and delay in transit are to be transacted by the consignee directly with the carrier. Claims for shortages or incorrect equipment must be made in writing to Seller within fifteen (15) days after receipt of the shipment. Failure to give such notice shall constitute unqualified

	acceptance and a waiver by Purchaser of all claims for shortages or incorrect equipment.		terminated by Seller due to Purchaser's breach of the provisions of the license.
11.	CHANGES	14.2	The Program shall be used only in connection with Seller's Equipment. Purchaser shall have no right to use, print, display modify or disclose the Program nor duplicate or copy the Program, with the exception that one copy may be made for security purposes.
11.1	Seller reserves the right to make changes in design or to add any improvement on Equipment or other goods at any time, without incurring any obligations to install same on equipment or goods previously purchased or leased. Any changes caused or requested by Purchaser affecting the Equipment or otherwise affecting the scope of work must be accepted by Seller and resulting adjustment to price, schedule, or both, mutually agreed in writing.	14.3	The Program is proprietary to Seller and this license allows Purchaser only the limited right to use the Program, and nothing contained herein shall be deemed to convey any title to or ownership in the Program to Purchaser.
11.2	The price and schedule shall be adjusted to take account of any increase or decrease in cost or delivery delay resulting from a change in the applicable Laws (including the introduction of new Laws and the repeal or modification of existing Laws) which affect Seller in the performance of its obligations under the order or changes any taxes, charges, levies or duties. For the purposes hereof, "Laws" means all national (or state, regional, provincial, municipal or local) legislation, statutes, ordinances, norms, decrees and other laws, and regulations and by-laws of any legally constituted public authority.	14.4	Notwithstanding anything herein to the contrary, the Seller's supplied system is designed to be connected to and to communicate information via a network interface. Accordingly, it is Purchaser's sole responsibility to ensure that a secure connection is maintained between the system and Purchaser's network or any other network, as the case may be. Purchaser shall establish and maintain any appropriate measures, (such as but not limited to: the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) in order to protect the system including its network and external interfaces against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. Seller and its affiliates shall not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information, and Purchaser hereby undertakes to indemnify and hold Seller harmless for same.
12.	TESTING & ACCEPTANCE OF EQUIPMENT	15.	DELAYS
12.1	Testing of the Equipment before shipment shall be carried out in accordance with Seller's test procedures and at Seller's cost. Additional tests shall be agreed upon specifically between Seller and Purchaser and shall be charged to Purchaser.		If Seller is delayed in the performance of its obligations by an action or omission of Purchaser or anyone employed or engaged by Purchaser directly or indirectly, then the contractual time towards Seller's performance hereunder shall be extended by a period at least equal to the duration of such delay. Seller shall be reimbursed by Purchaser for reasonable costs incurred by Seller as a result of such delay.
12.2	Purchaser shall examine the Equipment upon taking possession of same and shall inform Seller immediately in writing of all defects and deficiencies for which Seller is responsible. If Purchaser omits to so notify Seller within fifteen (15) days of Purchaser's possession of the Equipment, same shall be deemed to have been accepted.	16.	RESPONSIBILITY OF PURCHASER
12.3	Acceptance tests are carried out only if they have been agreed upon in writing by Seller. As far as circumstances allow, such tests will be carried out in Seller's factory. If, for reasons beyond Seller's control, the acceptance tests cannot be carried out within the specified time, the qualities to be determined by these tests shall be deemed proved.		The operation of the Equipment is within the exclusive control of Purchaser and Purchaser shall indemnify and save Seller harmless from any and all expense and liability (including legal fees on a solicitor to client basis and costs) incurred by or imposed upon Seller based upon any Advice of Seller, injury to persons (including death) or damage to property (including the Equipment) resulting from Purchaser's tests, cleaning, operation, or maintenance of the Equipment or from modifications to the Equipment by Purchaser or by third parties.
12.4	If it is found from one of the aforementioned tests that the Equipment does not fulfil the terms of the order, Purchaser shall make available to Seller suitable opportunity to remedy any deficiency.	17.	TERMINATION FOR CONVENIENCE
12.5	Purchaser shall have no other rights than the rights outlined above, in case of delivery of deficient Equipment.		This Agreement may be terminated by Purchaser only upon thirty (30) days' prior written notice and payment of termination charges, including but not limited to, all costs incurred prior to the effective date of notice of termination and all expenses incurred by Seller attributable to the termination, plus a fixed sum of ten percent (10%) of the final total price to compensate for the disruption in scheduling, planned production and other indirect costs.
13.	TECHNICAL DOCUMENTS	18.	EXPORT CONTROLS
13.1	Technical documents, such as drawings, descriptions, illustrations and the like, and all weight data, shall serve as an approximate indication only, provided they have not been expressly specified as binding. Seller reserves the right to make any alterations considered necessary.	18.1	Purchaser represents and warrants that the Equipment and Services provided hereunder and the "direct product" thereof are intended for civil use only and will not be used, directly or indirectly, for the production of chemical or biological weapons or of precursor chemicals for such weapons, or for any direct or indirect nuclear end use. Purchaser agrees not to disclose, use, export or re-export, directly or indirectly, any information provided by Seller or the "direct product" thereof as defined in the applicable Export Control Regulations, except in compliance with such Regulations.
13.2	All plans, drawings, technical specifications, documents, software, microfilm, data, or proprietary information relating to the Equipment sold, distributed or manufactured hereunder shall be treated in confidence by Purchaser, who shall ensure the confidentiality thereof. They remain Seller's exclusive property and may be neither copied nor reproduced nor communicated to a third party in any way whatever nor used for manufacture of any goods or product similar to the Equipment, or parts thereof. They may be used only for operation and maintenance of the Equipment, under terms and conditions specified by Seller.	18.2	If applicable, Seller shall file for an export license, but only after appropriate documentation for the license application has been provided by Purchaser. Purchaser shall furnish such documentation within a reasonable time after order acceptance. Any delay in obtaining such license shall suspend performance of this Agreement by Seller. If an export license is not granted or, if once granted, is thereafter revoked or modified by the
13.3	All documents submitted with tenders that do not result in an order shall be, at Seller's option, either destroyed or returned to Seller on request.		
14.	SOFTWARE		
14.1	Where Seller supplies a system program, Seller hereby grants to Purchaser a revocable non-transferable and non-exclusive license to use the computer software packages, related materials, and the intellectual property contained therein, furnished hereunder (collectively, the "Program") for the limited use described herein and in the other documents transmitted to Purchaser by Seller. This license shall remain in effect unless		

	appropriate authorities, this Agreement may be canceled by Seller without liability for damages of any kind resulting from such cancellation. At Seller's request, Purchaser shall provide to Seller a Letter of Assurance and End-User Statement in a form reasonably satisfactory to Seller.	20.4	Purchaser will make its site medical facilities and resources available to Seller personnel who need immediate medical attention.
19.	BRIBERY AND CORRUPTION	21.	GENERAL
19.1.	Purchaser hereby warrants that it will not, directly or indirectly, and it has no knowledge that other persons will, directly or indirectly, make any payment, gift or other commitment to its customers, to government officials or to agents, directors and employees of Seller or any other party in a manner contrary to applicable laws (including but not limited to the <i>Corruption of Foreign Public Officials Act</i> (Canada), the <i>Foreign Corrupt Practices Act</i> (United States) and, where applicable, legislation enacted by member States and signatories implementing the OECD Convention Combating Bribery of Foreign Officials) and shall comply with all relevant laws, regulations, ordinances and rules regarding bribery and corruption.	21.1	Purchaser shall not assign this contract or any part thereof without the written consent of Seller.
19.2.	Nothing in this Agreement shall render Seller liable to reimburse Purchaser for any such consideration given or promised.	21.2	Any order received by Seller is subject to credit approval and may be cancelled if Purchaser's credit standing is not reasonably satisfactory to Seller.
19.3.	Purchaser's material violation of any of the obligations contained in Section 19.1. above may be considered by Seller to be a material breach of this Agreement and shall entitle Seller to terminate this Agreement with immediate effect and without prejudice to any further right or remedies on the part of Seller under this Agreement or applicable law. Purchaser shall indemnify Seller for all liabilities, damages, costs or expenses incurred as a result of any such violation of the above mentioned obligations and termination of this Agreement.	21.3	This Agreement and any order or contract placed hereunder shall be interpreted according to the laws of the Canadian province in which Purchaser is located and the federal laws of Canada therein applicable, or if Purchaser is located in the United States of America, the laws of the State of New York, the whole to the exclusion of their conflict of law rules. The Courts of the District of Montreal, Province of Quebec, shall have jurisdiction in any matter relating to same, but Seller shall also have access to the jurisdiction of the competent Courts where Purchaser is located. Each of Seller and Purchaser expressly and irrevocably waives any right to trial by jury.
19.4.	Purchaser understands that Seller's Code of Conduct is available for consultation online at http://www.abb.com/integrity . Purchaser agrees to perform its contractual obligations under this Agreement with substantially similar standards of ethical behavior as those found in Supplier's Code of Conduct.	21.4	No penalties or liquidated damages shall apply in respect of Seller's obligations hereunder, unless accepted in writing by Seller's authorized representative.
19.5.	Seller has established the following reporting channels where Purchaser and its employees may report suspected violations of applicable laws, policies or standards of conduct: Web portal: www.abb.com/integrity Telephone: number specified on the above Web portal Mail: address specified on the above Web portal	21.5	These terms and conditions shall supersede and abrogate all previous communications, obligations, commitments or agreements, oral or written, expressed or implied, between Purchaser and Seller, in relation to this Agreement, and constitute the entire agreement between Seller and Purchaser as to the object thereof. All provisions under the United Nations Convention on Contracts for the International Sale of Goods are hereby expressly waived.
20.	HEALTH AND SAFETY	21.6	The Parties acknowledge having specifically requested that this Agreement and all related documents and correspondence be drafted in English. <i>Les Parties reconnaissent avoir exigé que la présente entente et tous les documents s'y rapportant soient rédigés en anglais.</i>
20.1.	To the extent Seller provides Services at any site under the care, custody or control of Purchaser, Purchaser shall identify any potential health and safety hazard at site and maintain healthy and safe working conditions at such site, including, without limitation, implementing appropriate policies and procedures regarding hazardous materials, electrical safety, control of hazardous energy (lock-out/tag-out), working at heights, confined space entry, machine guarding, lifting loads, energization and de-energization of power systems (electrical, mechanical and hydraulic), the whole using safe and effective industry practices. Purchaser shall timely advise Seller in writing of all applicable site-specific health, safety, security and environmental requirements and procedures.	21.7	Any addenda or appendices to this Agreement, to be applicable to any order hereunder, must be signed by both Purchaser's and Seller's respective authorized representatives.
20.2	Seller shall comply with the health and safety policies and procedures communicated by Purchaser for the site, applicable laws and regulations and similar Seller's policies and procedures, it being understood that the more stringent mandatory health and safety policies and procedure shall be applied. Without limiting Purchaser's responsibilities under this Section 20, Seller has the right but not the obligation to, from time to time, review and inspect applicable health, safety, security and environmental documentation, procedures and conditions at the site.	21.8	The invalidity in whole or in part of any part of this Contract shall not affect the validity of the remainder of the Contract.
20.3	If, in Seller's reasonable opinion, the health, safety, or security of personnel or the site is, or is apt to be, imperiled by security risks, terrorist acts or threats, the presence of or threat of exposure to hazardous materials, or unsafe working conditions, Seller may, in addition to other rights or remedies available to it, evacuate some or all of its personnel from site, suspend performance of all or any part of the Agreement, and/or remotely perform or supervise work, in which case Seller shall be indemnified by Purchaser for any costs or delays arising out thereof.	21.9	Either party's failure to enforce any provisions hereof shall not be construed a waiver of party's right thereafter to enforce each and every such provision.

Government of Puerto Rico

Puerto Rico Electric Power Authority



Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES
Submittal to COR3 and FEMA



***Units 1, 2, 3 Inspections,
Cambalache Power Plant***

1/28/2022



Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes



Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	Cambalache Power Plant – Units 1, 2, 3 Inspections
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number (Formerly Project Worksheet)	136271 - MEPA078 PREPA Island Wide FAASt Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: <Name>

<Insert title here>

PREPA Project Sponsor: <Name >

<Insert title here>



Section 2. Facilities

2.1. Facilities List

Name	GPS Location
Cambalache Power Plant	
unit 1	
unit 2	
unit 3	

Note: GPS coordinates are required for all facilities.

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

Cambalache Power Plant wants to perform a Major Inspection (Class C) on its units 1, 2, 3. A Long Term Service Agreement exists for the A, B & C inspections on the Cambalache Units. This contract is an Administration Contract that started in September 2003, amended in April 2011 with effectivity until December 31, 2023. The contract number is TSM 23-03 and is manage by PREPA's Engineering and Technical Services Division. The purpose is to provide related parts, services, repairs, technical field advisors, supervision, and site and shop repairs identified as "HGP Services" for all the inspections and the replacement of the scheduled Hot Gas Path parts (capital parts). The A & B are the minor inspections.

Section 3. Scope of Work



3.1. Scope of Work Description

The scope of work for the Units 1, 2, 3 Inspections of Cambalache Power Plant will consist of the following:

A. Mechanical Task:

- Mobilize and setup office, tools, receive, uncrate, clean and prepared all outage parts. TFA will check warehouse spare parts inventory.
- Locate, check and prepare all OEM tools at the site.
- Purchase, organize and identify all consumables to be used during the work. Transmit copies of MSDS to PREPA's Environmental Engineer.
- Conduct pre job safety orientation of contractor Staff with PREPA's Engineer present.
- Remove combustor enclosure roof.
- Remove burner, dismantle, inspect and test fuel nozzle assembly.
- Remove combustor enclosure tower halves.
- Remove combustion chamber piping.
- Remove combustion chamber.
- Remove and safely store the original insulation blankets of thermal block.
- Disassemble inspect, reassemble the combustion chamber.
- Remove blow off valves and silencer.
- Dismantle, clean inspect blow off valves.
- Remove air intake elbow.
- Remove air intake manifold.
- Loosen bolts gas turbine casing.
- Remove hot gas casing upper part.
- Remove gas turbine vane carrier upper part.
- Remove compressor diffuser upper part.
- Remove bearing covers.
- Remove rotor, de-blade HGP Parts as requires, cleaning and NDE (Non Destructible Examination).
- Perform C Inspection HGP Parts Blading work scope.
- Remove vane carrier, lower part.
- Remove and store GT belly piping.
- Clean and inspect GT casing halves.
- Install rotational carrier, lower part.
- Install rotor, alignment check.
- Vane and blade tip grinding.
- Final install rotor after cleaning grinding debris from lower casing.
- Install compressor diffuser and vane carrier, upper part.
- Install hot gas casing upper part • Install gas turbine outer casing, torque bolts.
- Install insulation blankets of thermal block (supplied by PREPA).
- Install air intake manifold and air intake elbow.
- Install blow off valves and sound damper.
- Assemble combustion chamber.
- Install roof panels.
- Install combustion chamber.
- Install combustion piping.
- Install combustion enclosure.
- Motor roll / install burner.



- Reconnect all piping associated with burner, install all insulation components afterward.
- Install combustor enclosure roof.
- Start-up unit in coordination with and assisted by PREPA Operation Personnel.
- Monitor the overhauled unit for vibration.
- Provide balancing if required.

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards:** Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project:** Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
 - a. Other improvements, not required by codes and standards
 - b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate)

If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.

Restores to Codes/Standards

Note: If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.

3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?

4.1. Codes, Specifications, and Standards



Yes/No. If yes, describe how incorporated below.
<ul style="list-style-type: none"> • (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE) • (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE) • Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730-B2 - U.S. Department of Agriculture Rural Electric Service (RUS) • International Building Code (IBC) - International Code Council (ICC) • International Energy Conservation Code (IECC) - International Code Council (ICC) • International Existing Building Code (IEBC) - International Code Council (ICC) • National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers • National Electrical Code (NEC) - National Fire Protection Association (NFPA) • FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.
<ul style="list-style-type: none"> • 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA) • 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA) • ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE) • International Building Code (IBC) - International Code Council (ICC) • Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA) • Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA) • RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS) • Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.

Cost Type	Amount (\$M)
Major Inspection (Class C) and Parts – unit 1	\$4,000,000.00
Major Inspection (Class C) and Parts – unit 2	\$4,000,000.00
Major Inspection (Class C) and Parts – unit 3	\$4,000,000.00
Total Project Estimated Cost	\$12,000,000.00



Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: If available, detailed engineering cost estimates will be included as an attachment.

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

Program Manager's Printed Name

Date

Title

Signature

Section 9. PREPA Project Sponsor Comments

Comments
<Insert any comments here>

PREPA Project Sponsor's Printed Name

Date

Title

Signature



Section 10. Attachments

10.1. Project Detailed Cost Estimates

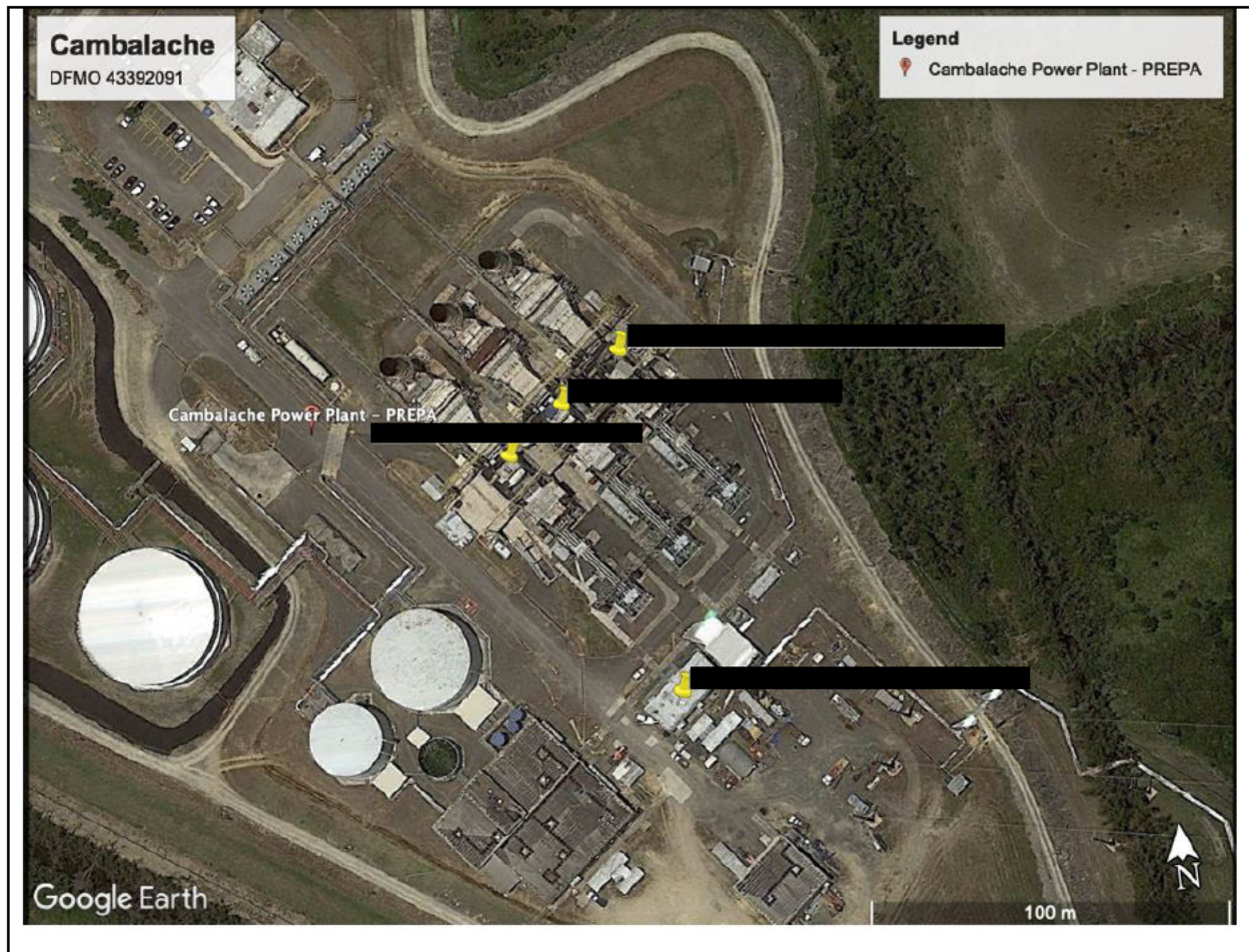
Please see attached the following:

- ALSTOM Proposal for Amendment_TSM 23-03_2011
- Hot Gas Path Parts List_ALSTOM TSM 23-03
- Justification, SOW and Cost Estimate_Cambalache Units 1-2-3

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures



10.4. Other: (Please Describe)

N/A

<u>Project Name:</u>	Long Term Service Agreement for Mayor Inspections GT1, GT2 & GT3
<u>Location:</u>	Cambalache Power Plant
<u>Asset:</u>	Cambalache GT1, GT2 & GT3
<u>Estimated cost:</u>	\$ 12,000,000
<u>Active Contract:</u>	TSM 23-03. Direct Negotiation with GE.
<u>Asset Suite Data:</u>	No data available.
<u>General Description:</u>	<p>A Long Term Service Agreement for the A, B & C (Major) inspections on the Cambalache Units. This contract is an Administration Contract that started in September 2003, amended in April 2011 with effectivity until December 31, 2023. The contract number is TSM 23-03 that is manage by PREPA's Engineering and Technical Services Division. This type of contract is considered pay as you go, in which the units usage is paid quarterly. Every quarter the Plant receives an invoice for the units Equivalent Operating Hours (EOH) usage. From this predetermined amount for every EOH, 78% correspond to the parts cost and the remaining 22% is for the labor.</p> <p>The purpose is to provide related parts, services, repairs, technical field advisors, supervision, and site and shop repairs identified as "HGP Services" for all the inspections and the replacement of the scheduled Hot Gas Path parts (capital parts). The A & B are the minor inspections. During the term of the HGP Plan perform and provide the following HGP parts and services with respect to the Unit:</p> <ul style="list-style-type: none">• Supply of all Scheduled HGP parts and related consumables for the schedule type "A", "B", and "C" Inspections as outlined in document entitle Recommended Inspection valid for Gas Turbine Type GT11N1 HTCT 690476 rev G.• Supply of pre-assembled exchangeable vane carriers for scheduled "C" Inspections.• Supply of unscheduled HGP Parts.• TFA's required for opening and closing the Unit , removal/reinstallation of HGP Parts and recommissioning associated with Scheduled type "C" Inspections and for any repair or replacement necessary.• One TFA's for Scheduled "A" Inspection• Two TFA's (one mechanical one commissioning) for Scheduled "B" Inspection.• Deliver HGP Parts for Scheduled "A", "B", and "C" Inspections prior to the scheduled date.• The EOH (Equivalent Operating Hours) interval between Scheduled "C" inspections will be 16,000 hrs.

- The EOH (Equivalent Operating Hours) interval between Scheduled "A" and "B" minor inspections will be 4,000 hrs.

Scope of Work:

The contractor will perform the scope of work specified by for a Class C Inspection on Cambalache Units #1, #2 and #3. Except for the craft labor and site personnel support which shall be furnished by PREPA at no cost or expense to the contractor as may require to perform work (contractor shall promptly advise PREPA of its support requirements, as they become known), the scope of work includes the following:

I. Mechanical Task

- Mobilize and setup office, tools, receive, uncrate, clean and prepared all outage parts. TFA will check warehouse spare parts inventory.
- Locate, check and prepare all OEM tools at the site
- Purchase, organize and identify all consumables to be used during the work. Transmit copies of MSDS to PREPA's Environmental Engineer.
- Conduct pre job safety orientation of contractor Staff with PREPA's Engineer present
- Remove combustor enclosure roof.
- Remove burner, dismantle, inspect and test fuel nozzle assembly.
- Remove combustor enclosure tower halves
- Remove combustion chamber piping
- Remove combustion chamber
- Remove and safely store the original insulation blankets of thermal block
- Disassemble inspect, reassemble the combustion chamber
- Remove blow off valves and silencer
- Dismantle, clean inspect blow off valves
- Remove air intake elbow
- Remove air intake manifold
- Loosen bolts gas turbine casing
- Remove hot gas casing upper part
- Remove gas turbine vane carrier upper part
- Remove compressor diffuser upper part
- Remove bearing covers
- Remove rotor, de-blade HGP Parts as requires, cleaning and NDE (Non Destructible Examination)
- Perform C Inspection HGP Parts Blading work Scope
- Remove vane carrier, lower part

- Remove and store GT belly piping
- Clean and inspect GT casing halves
- Install rotational carrier, lower part
- Install rotor, alignment check
- Vane and blade tip grinding
- Final install rotor after cleaning grinding debris from lower casing
- Install compressor diffuser and vane carrier, upper part
- Install hot gas casing upper part
- Install gas turbine outer casing, torque bolts
- Install insulation blankets of thermal block (supplied by PREPA)
- Install air intake manifold and air intake elbow
- Install blow off valves and sound damper
- Assemble combustion chamber
- Install roof panels
- Install combustion chamber
- Install combustion piping
- Install combustion enclosure
- Motor roll / install burner
- Reconnect all piping associated with burner, install all insulation components afterward
- Install combustor enclosure roof
- Start up unit in coordination with and assisted by PREPA Operation Personnel
- Monitor the overhauled unit for vibration
- Provide balancing if required

II. Extra Work

Contractor will not proceed to perform any extra work without PREPA's approval. A written Extra Work Authorization, to perform extra work will be issued by the contractor Site Project Manager for signature by PREPA. PREPA will received a copy of the Extra Work Authorization. Extra work will billed at in accordance with the contractor rate sheet negotiated in the contract.

III. Personnel and Facility Equipment

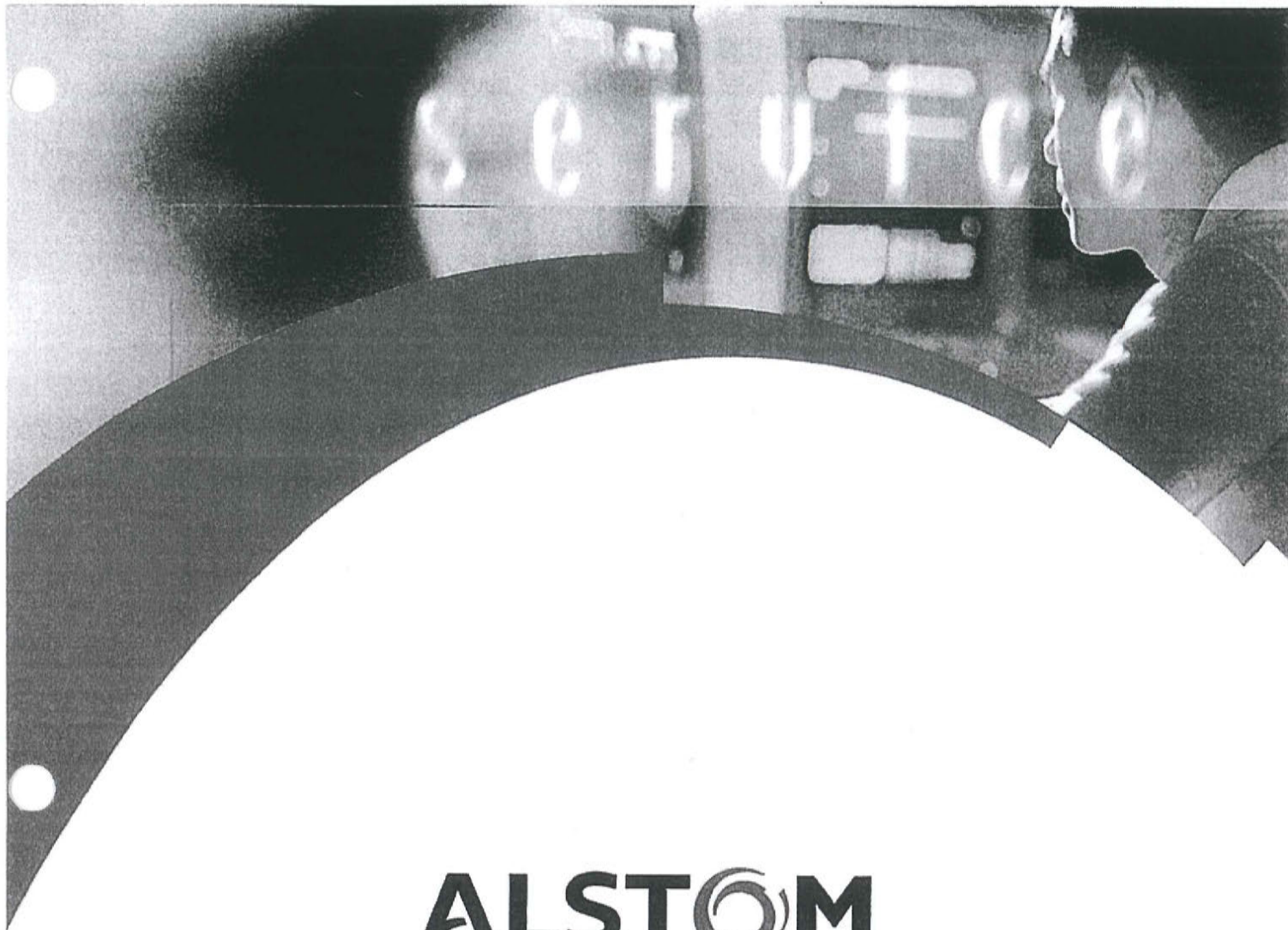
Contractor will provide

- Site Manager
- Two Superintendents
- One Expeditor
- One Office Manager
- Two Mechanical TFA's
- One Balancing Engineer
- One Commissioning Engineer

- Two Bladder
 - NDE (Non Destructible Examination) Subcontractor
 - One Tool Room Manager
 - One Janitor
 - One Driver/Runner
 - Tools, rental equipment, site facilities, consumables as described
- IV. Craft Personnel
- PREPA will provide all skilled craft labor including personal protective gear as required to support work
- V. Facility and Equipment provided by the contractor
- Two trailers for office facilities
 - One trailer for craft labor break room
 - Blade and Vane tip grinder
 - Consumables
 - Job-site Pickup truck
 - Safety equipment
 - Office supplies, Multifunction Machine and service for same
 - Welding rod
 - Parts cleaning (solvent wash type) station
 - Chemical toilets
 - Lumber and weather protection
 - Air compressor and welding machine
 - Aluminum Oxide blasting equipment
 - Complete tool trailer manned by trained attendant
 - Container for consumables and small parts
 - Thirty Ton Cherry picker for mobilization and demobilization
 - Five Ton fork truck for daily use during the outage
 - Manlift equipment to access the roof area and intake elbow bolts
 - Portable Machine Shop Container

Disposal:

PREPA Cambalache will retain all removed equipment and material for proper disposal according to applicable regulations. With the exception of the HGP capital parts that are shipped by the contractor to a shop for their refurbishment.

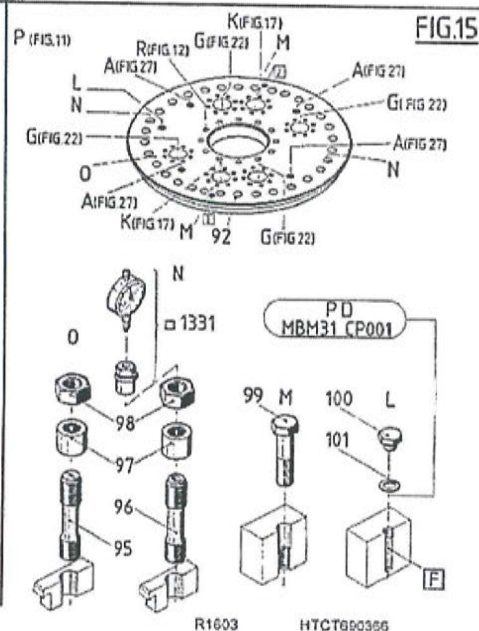
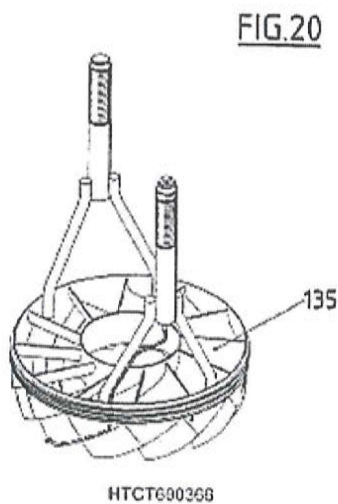
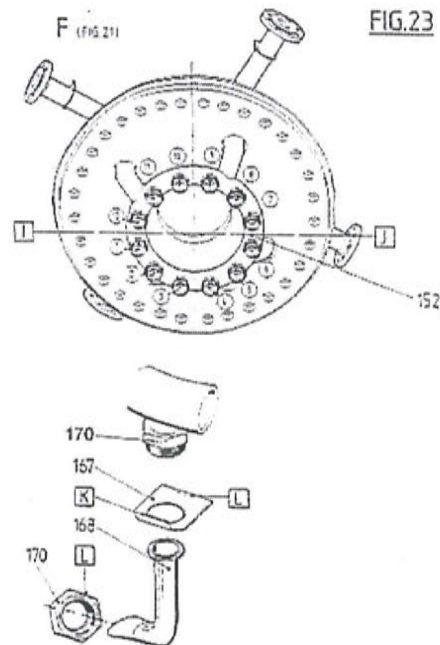
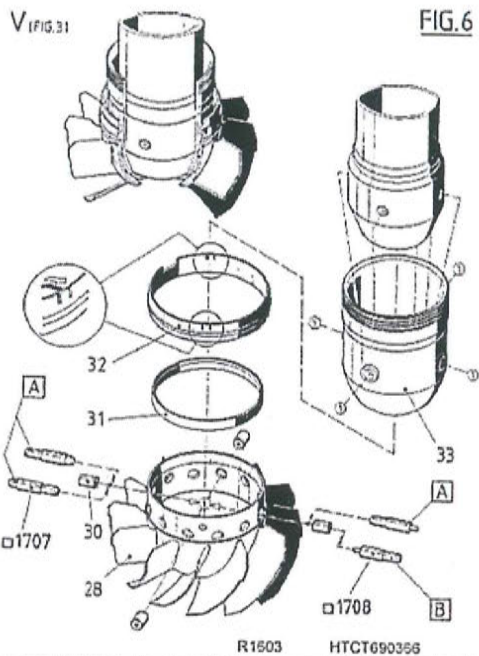


ALSTOM

**Hot Gas Path Parts
GT11N1
Standard Combustor
Cambalache**

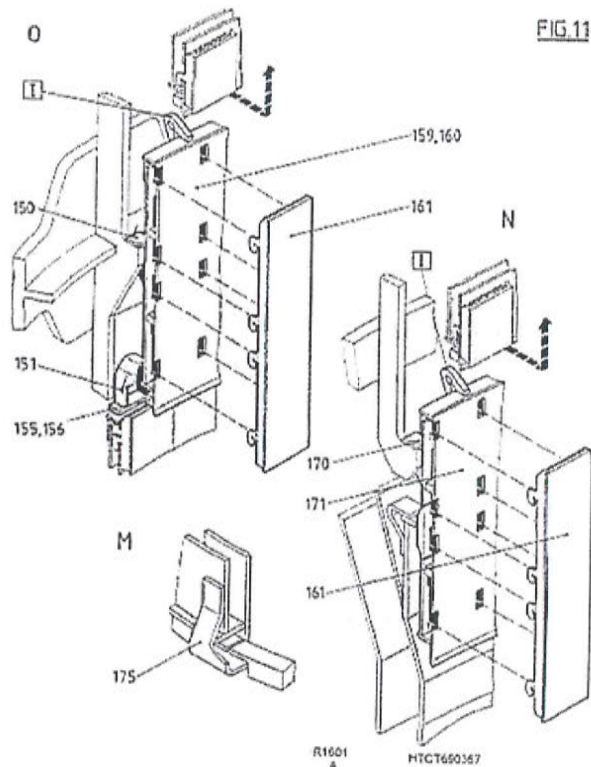
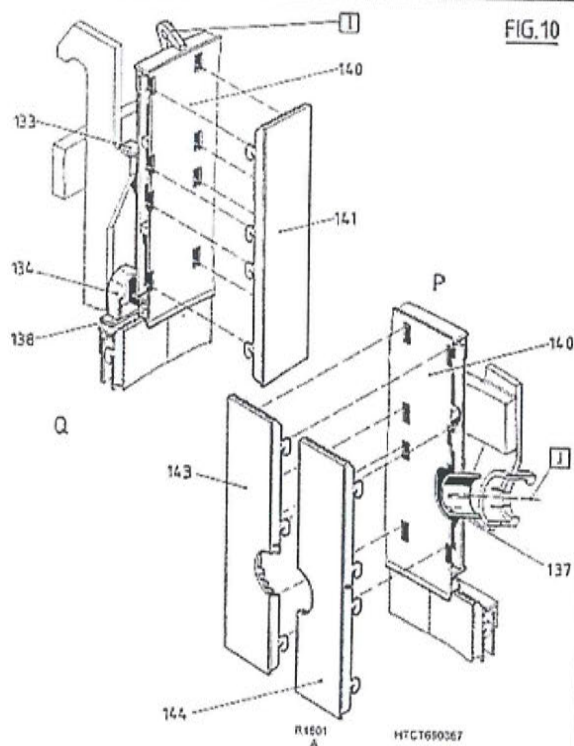
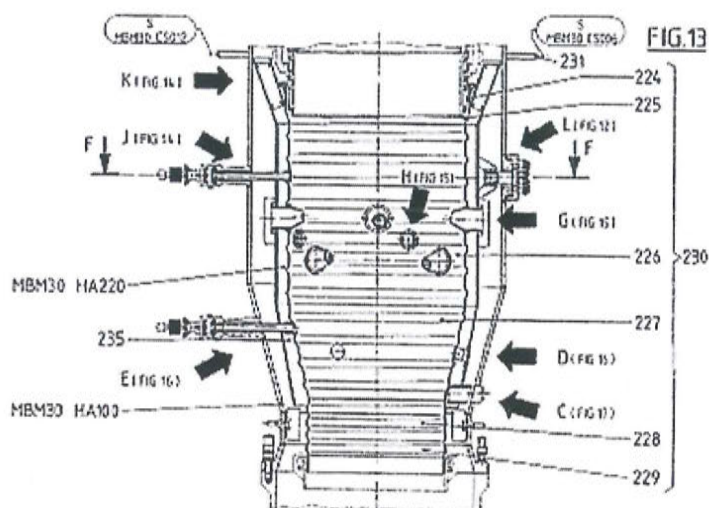
Note: Parts covered by this Hot Gas Path Protection Plan are those with a part number in the left hand column of the following lists. Other items mentioned and/or illustrated are only to aid in identification.

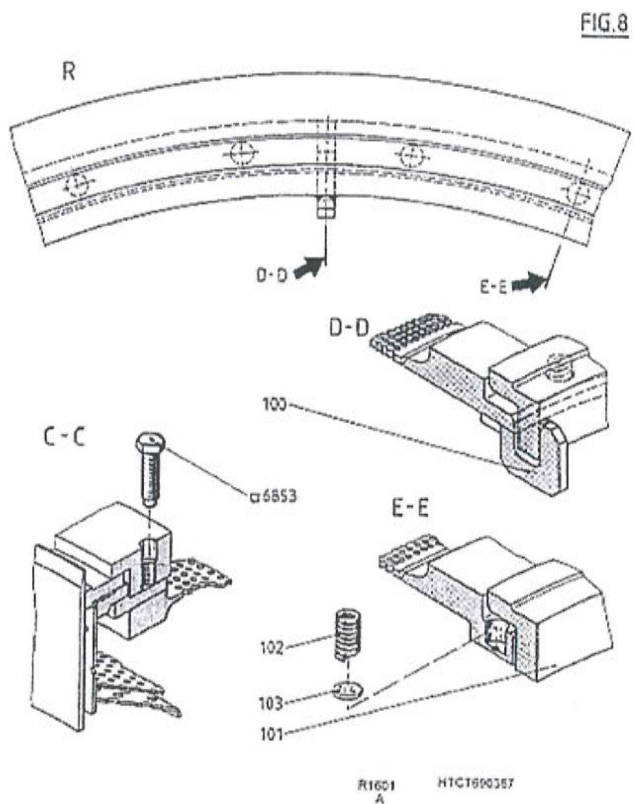
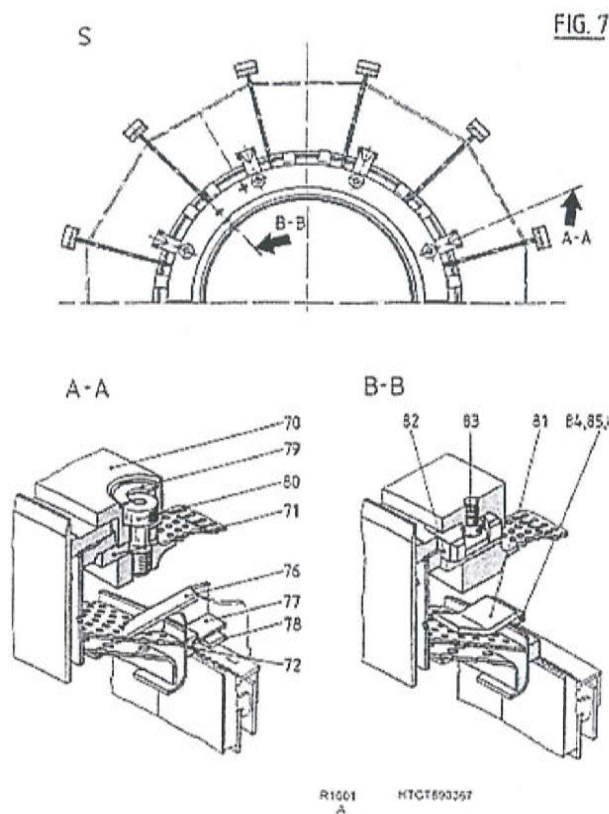
Burner		
Number	Pos. #	Description
HTCT690366	P27	Inner Swirl Basket Assembly
HTCT690366	P135	Outer Swirl Basket
HTCT690366	P95	Expansion Stud
HTCT690366	P97	Expansion Sleeve
HTCT690366	P98	Hexagonal Nut
HTCT690366	P00167	Safety Locking Plate
HTCT690366	P00168	Nozzle Line
HTCT690366	P00170	Weld-On Tube Union DN 40



Combustor		
Number	Pos. #	Description
HTCT 690 367	14	Expansion Stud
HTCT 690 367	15	Contact Ring
HTCT 690 367	16	Nut
HTCT 690 367	17	Covering Hood
HTCT 690 367	28	Positioning Pin
HTCT 690 367	51	Sieve Basket
HTCT 690 367	52	Guide
HTCT 690 367	53	Lower Cone
HTCT 690 367	70	Fastening Ring
HTCT 690 367	71	Ring
HTCT 690 367	73	Seal, 8 Segments, above row A tile
HTCT 690 367	76	Support Strut
HTCT 690 367	77	Bracket
HTCT 690 367	78	Plate
HTCT 690 367	79	Disc
HTCT 690 367	80	Hexagonal Head Bolt
HTCT 690 367	81	Lug
HTCT 690 367	82	Securing Wedge
HTCT 690 367	83	Hexagonal Head Bolt
HTCT 690 367	100	Hook
HTCT 690 367	101	Sealing Ring
HTCT 690 367	102	Cylinder Press Spring
HTCT 690 367	103	Disc
HTCT 690 367	120	Support Basket
HTCT 690 367	122	Guide
HTCT 690 367	133	Suspension Lug, Row A
HTCT 690 367	134	Retainer, Row A
HTCT 690 367	134	Spacer Block
HTCT 690 367	137	Support Pipe
HTCT 690 367	138	Gasket Ring Row A - B
HTCT 690 367	140	Support Cylinder Row A, for spring tile
HTCT 690 367	145	Finned Segment, Coated
HTCT 690 367	145	Finned Segment, Coated, Spring Loaded
HTCT 690 367	146	Finned Segment, Left, Spring Loaded
HTCT 690 367	147	Finned Segment, Right, Spring Loaded
HTCT 690 367	150	Suspension, Row B & C
HTCT 690 367	151	Retainer, Row B & C
HTCT 690 367	151	Spacer Block
HTCT 690 367	155	Gasket Ring Row B - C
HTCT 690 367	156	Gasket Ring Row C - D
HTCT 690 367	159	Support Cylinder Row B, for spring tiles
HTCT 690 367	160	Support Cylinder Row C, for spring tiles
HTCT 690 367	161	Finned Segment, Coated, W/O Spring, New
HTCT 690 367	161	Finned Segment, Coated, Spring Loaded
HTCT 690 367	170	Suspension Row D
HTCT 690 367	171	Support Cylinder, Row D, for all 11N
HTCT 690 367	175	Safety Lock, Gasket Ring 138, 155, 156
HTCT 690 367	210	Support Bolt
HTCT 690 367	211	Suspension Assembly
HTCT 690 367	212	Bushing
HTCT 690 367	213	Suspension Lug

HTCT 690 367	219	Expansion Stud (M24-TKX140)
HTCT 690 367	220	Expansion Casing
HTCT 690 367	221	Hexagonal Nut (M24)
HTCT 690 367	222	Hexagonal Head Bolt (M24)
MBM30 HA220		Lower Combustor Insert





Hot Gas Casing		
Number	Pos. #	Description
HTCT 690 371	1	Hot Gas Casing complete
HTCT 690 371	20	Centering Pin
HTCT 690 371	21	Dowel
HTCT 690 371	22	Hex head bolt M24, for HGC split line
HTCT 690 371	23	Safety fork, for HGC split line
HTCT 690 371	24	Pin, for support plate HGC
HTCT 690 371	25	Support plate, for HGC
HTCT 690 371	26	Support Plate, for HGC
HTCT 690 371	27	Bolt, for support plate HGC
HTCT 690 371	39	Shim for Family Belt Seal
HTCT 690 371	40	Belt Seal Segment
HTCT 690 371	41	Tension Spring

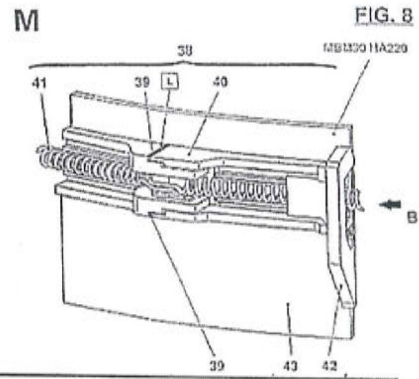
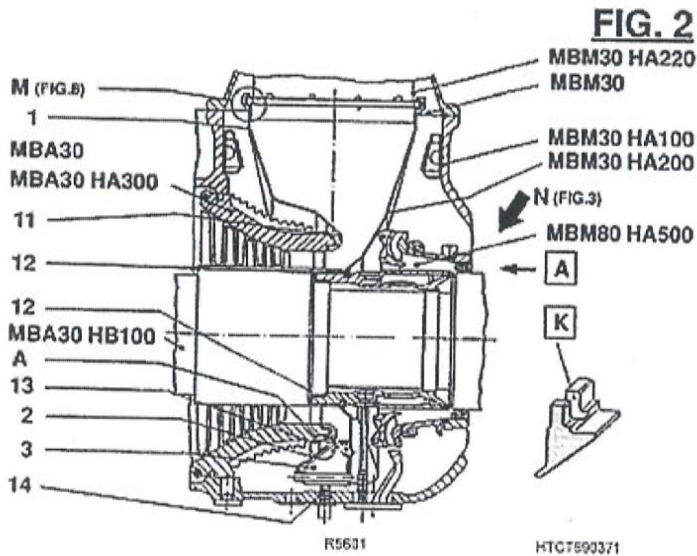


FIG. 4

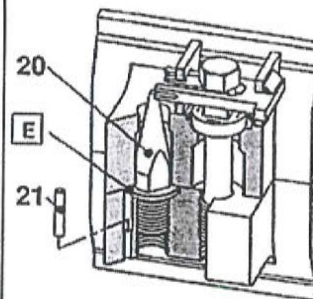


FIG. 5

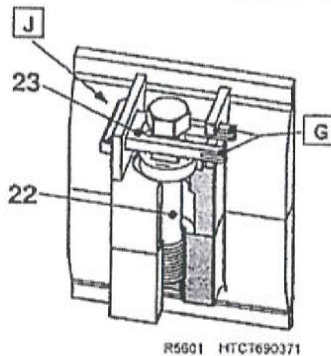


FIG. 6

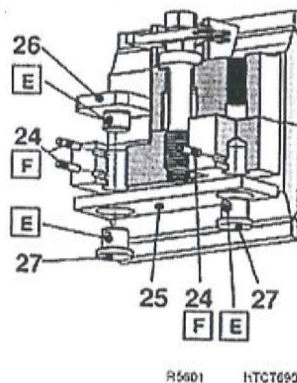
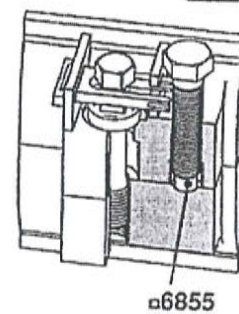


FIG. 7

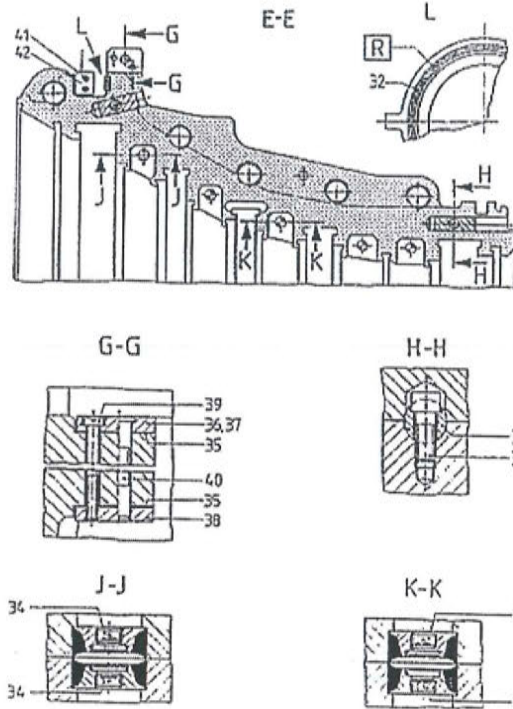


Vane Carrier		
Number	Pos. #	Description
HTCT 690 372	1	GT Vane carrier
HTCT 690 372	10	Plug
HTCT 690 372	12	Cylindric pin
HTCT 690 372	13	Bolt
HTCT 690 372	14	Distance washer
HTCT 690 372	16	Bolt
HTCT 690 372	17	Excenter sleeve
HTCT 690 372	18	Cylindric pin
HTCT 690 372	19	Socket head bolt
HTCT 690 372	20	Socket head bolt
HTCT 690 372	21	Washer
HTCT 690 372	22	Inlet C, Segment
HTCT 690 372	23	Pressure bolt
HTCT 690 372	24	Pressure spring
HTCT 690 372	27	Segment seal large
HTCT 690 372	28	Segments seal small
HTCT 690 372	30	Round Key
HTCT 690 372	31	Hex Socked Head Bolt, M16 X 40
HTCT 690 372	32	Sealing Ring, 4 part
HTCT 690 372	33	Plug Bushing
HTCT 690 372	34	Srew Plug
HTCT 690 372	35	Shim Packet
HTCT 690 372	36	Support Plate
HTCT 690 372	37	Support Plate
HTCT 690 372	38	Support Plate
HTCT 690 372	39	Fillister Head Bolt
HTCT 690 372	40	Dowel
HTCT 690 372	41	Socket Head Bolt
HTCT 690 372	42	Holding Down Plate
HTCT 690 372	43	Nut M48
HTCT 690 372	44	Expansin casing 48mm
HTCT 690 372	45	Expansion Stud M48 X 340
HTCT 690 372	46	Nut M56
HTCT 690 372	47	Expansion casing 56mm
HTCT 690 372	48	Expansion stud M56 X 380
HTCT 690 372	49	Expansion stud M56 X 400
HTCT 690 372	55	Vane Carrier Segment
HTCT 690 372	56	Vane Carrier Segment
HTCT 690 372	57	Vane Carrier Segment
HTCT 690 372	58	Vane Carrier Segment
HTCT 690 372	59	Vane Carrier Segment
HTCT 690 372	60	Turbine row 1 Vane
HTCT 690 372	61	Locking Bolt
HTCT 690 372	62	Spring Disc
HTCT 690 372	63	Spacer Ring
HTCT 690 372	64	Outher Seal Bushing
HTCT 690 372	65	Inner Seal Bushing
HTCT 690 372	66	Segment Seal
HTCT 690 372	60	Turbine row 1 Vane
HTCT 690 372	61	Locking Bolt
HTCT 690 372	62	Spring Disc

HTCT 690 372	63	Spacer Ring
HTCT 690 372	64	Outer Seal Bushing
HTCT 690 372	65	Inner Seal Bushing
HTCT 690 372	66	Segment Seal
HTCT 690 372	70	Vane carrier segment
HTCT 690 372	71	Vane carrier segment
HTCT 690 372	72	Vane carrier segment
HTCT 690 372	73	Turbine row 2 Vane
HTCT 690 372	74	Safety sleeve
HTCT 690 372	75	Pressure Spring
HTCT 690 372	76	Inner Seal Bushing
HTCT 690 372	77	Spacer Ring
HTCT 690 372	78	Disk Spring
HTCT 690 372	79	Outer Seal Bushing
HTCT 690 372	80	Locking Segment
HTCT 690 372	81	Segment Seal
HTCT 690 372	82	Bushing
HTCT 690 372	90	Turbine row 3 Vane
HTCT 690 372	91	Turbine row 3 Vane (boroscope hole)
HTCT 690 372	92	Turbine row 3 Vane (boroscope hole)
HTCT 690 372	93	Turbine row 3 Vane (end)
HTCT 690 372	94	Turbine row 3 Vane (end)
HTCT 690 372	95	Key
HTCT 690 372	96	Steel Band
HTCT 690 372	97	Steel Band
HTCT 690 372	98	Steel Band
HTCT 690 372	99	Lock Screw
HTCT 690 372	100	Shim
HTCT 690 372	101	Tin
HTCT 690 372	104	Sealing Rope 12mm, New Design
HTCT 690 372	101	Segment 1, New Design
HTCT 690 372	110	Turbine row 4 Vane Segment
HTCT 690 372	111	Turbine row 4 Vane End Segment
HTCT 690 372	112	Turbine row 4 Vane End Segment
HTCT 690 372	113	Locking Bolt
HTCT 690 372	114	Pressure Spring
HTCT 690 372	115	Lock Bolt
HTCT 690 372	116	Laby seal
HTCT 690 372	117	Wire
HTCT 690 372	119	Tin
HTCT 690 372	122	Sealing Rope 10mm, New Design
HTCT 690 372	119	Segment 2, New Design
HTCT 690 372	130	Turbine row 5 Vane Segment
HTCT 690 372	131	Locking Bolt
HTCT 690 372	132	Cylinder Pressure Spring
HTCT 690 372	150	HSS row A
HTCT 690 372	151	Segment Seal
HTCT 690 372	151	Segment Seal
HTCT 690 372	153	Cylinder Pin
HTCT 690 372	154	Distance Wire
HTCT 690 372	154	Distance Wire
HTCT 690 372	154	Distance Wire
HTCT 690 372	154	Distance Wire

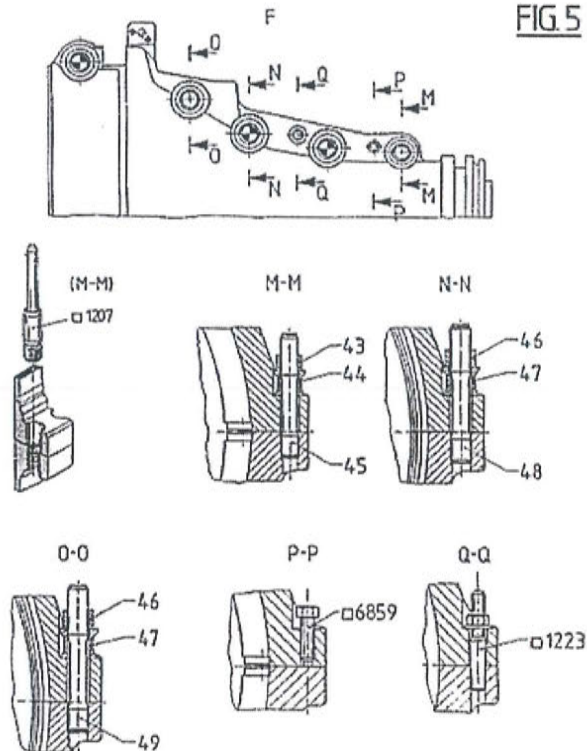
HTCT 690 372	154	Distance Wire
HTCT 690 372	154	Distance Wire
HTCT 690 372	160	HSS row B
HTCT 690 372	161	Segment Seal
HTCT 690 372	161	Segment Seal
HTCT 690 372	163	Cylinder Pin
HTCT 690 372	164	Distance Wire
HTCT 690 372	164	Distance Wire
HTCT 690 372	164	Distance Wire
HTCT 690 372	164	Distance Wire
HTCT 690 372	164	Distance Wire
HTCT 690 372	164	Distance Wire
HTCT 690 372	170	HSS row C
HTCT 690 372	171	Segment Seal
HTCT 690 372	173	Cylinder Pin
HTCT 690 372	174	Distance Wire
HTCT 690 372	174	Distance Wire
HTCT 690 372	174	Distance Wire
HTCT 690 372	174	Distance Wire
HTCT 690 372	174	Distance Wire
HTCT 690 372	174	Distance Wire
HTCT 690 372	180	HSS row D
HTCT 690 372	181	Segment Seal
HTCT 690 372	183	Cylinder Pin
HTCT 690 372	184	Distance Wire
HTCT 690 372	184	Distance Wire
HTCT 690 372	184	Distance Wire
HTCT 690 372	184	Distance Wire
HTCT 690 372	184	Distance Wire
HTCT 690 372	184	Distance Wire
HTCT 690 372	190	HSS row E
HTCT 690 372	191	Segment seal
HTCT 690 372	193	Cylinder Pin
HTCT 690 372	194	Distance Wire
HTCT 690 372	194	Distance Wire
HTCT 690 372	194	Distance Wire
HTCT 690 372	194	Distance Wire
HTCT 690 372	194	Distance Wire
HTCT 690 372	194	Distance Wire
HTCT 690 372	200	HSS row F
HTCT 690 372	201	Segment seal
HTCT 690 372	203	Cylinder Pin
HTCT 690 372	204	Distance wire
HTCT 690 372	204	Distance wire

FIG.4



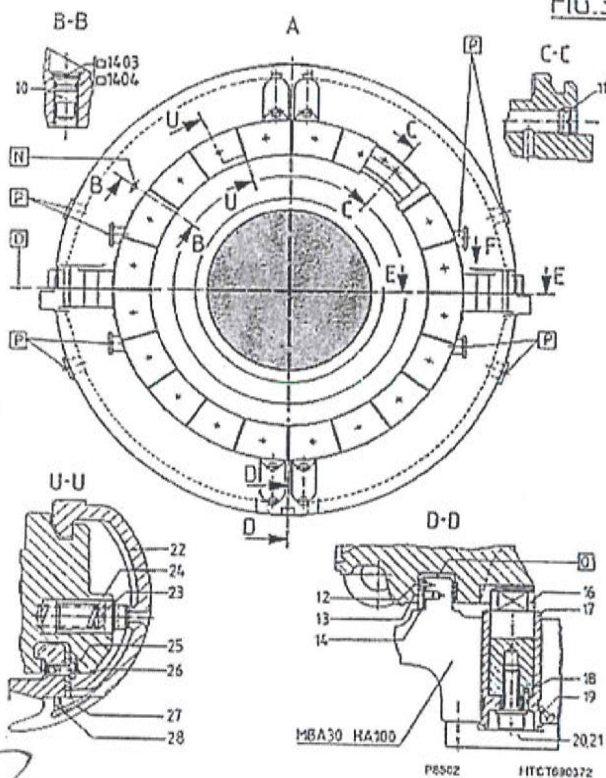
P8602 H1GT690372

FIG.5



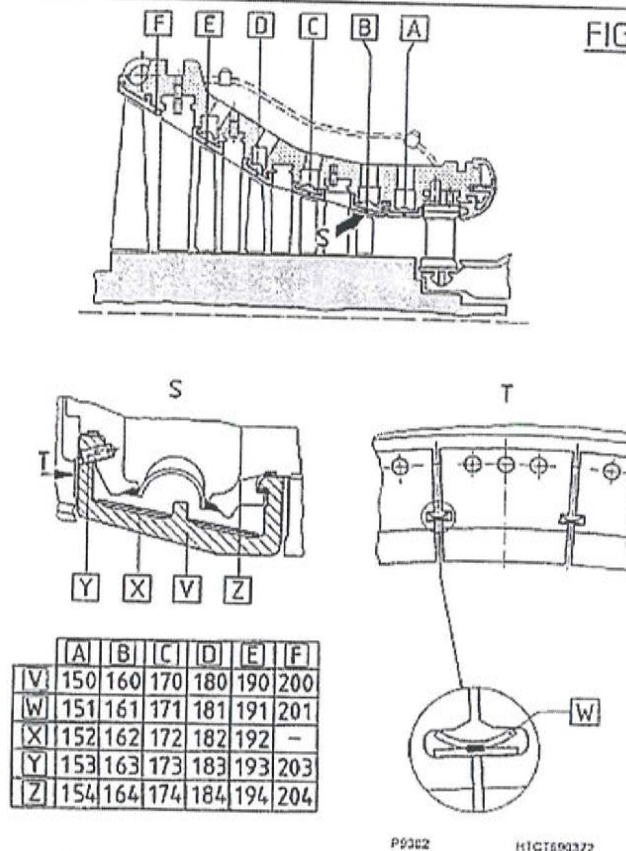
P8702 H1GT690372

FIG.3



P8602 H1GT690372

FIG.11



P9302 H1GT690372

	A	B	C	D	E	F
V	150	160	170	180	190	200
W	151	161	171	181	191	201
X	152	162	172	182	192	-
Y	153	163	173	183	193	203
Z	154	164	174	184	194	204

FIG. 6

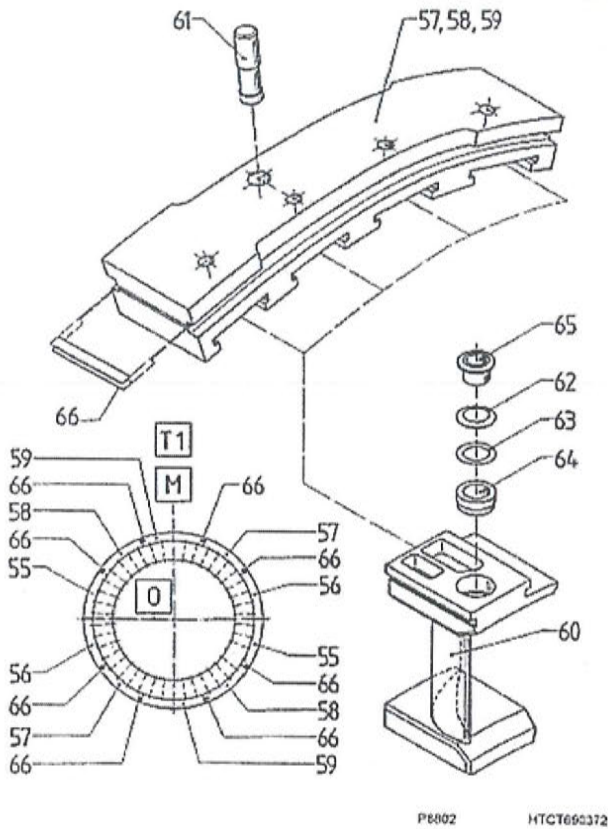


FIG. 7

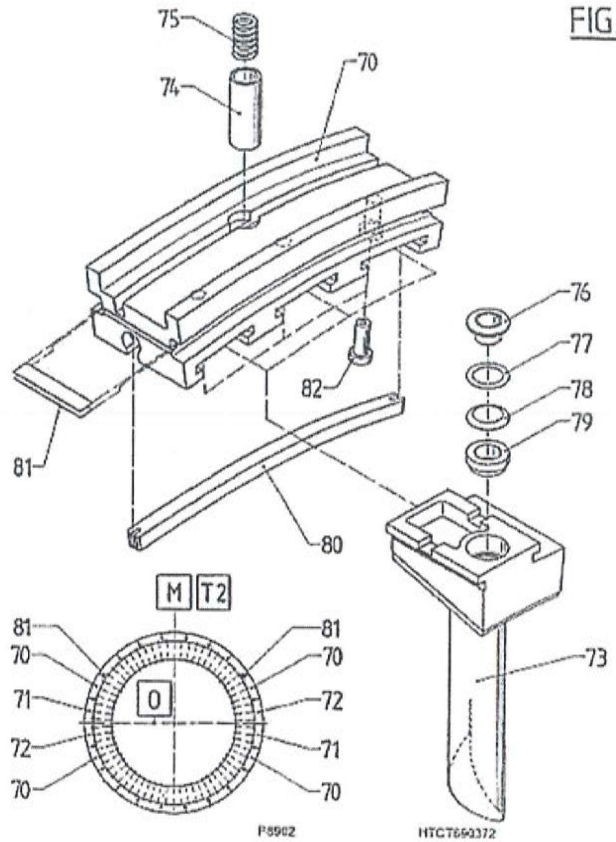


FIG. 8

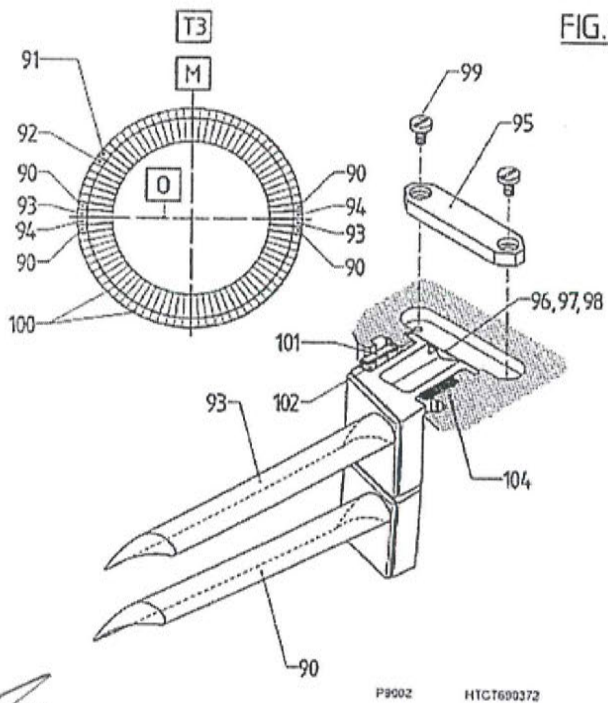


FIG. 9

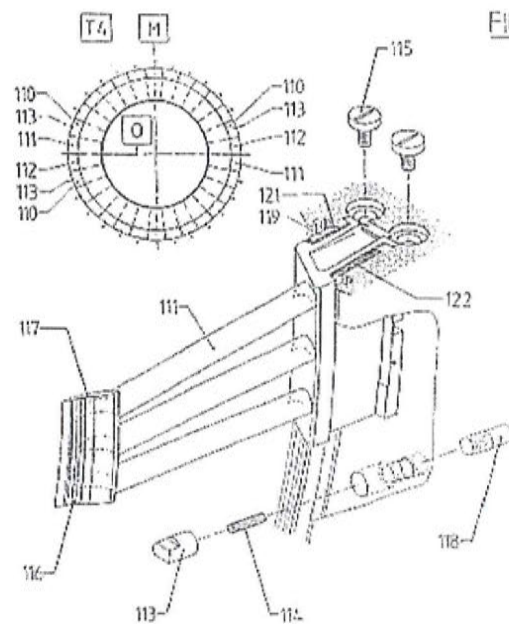
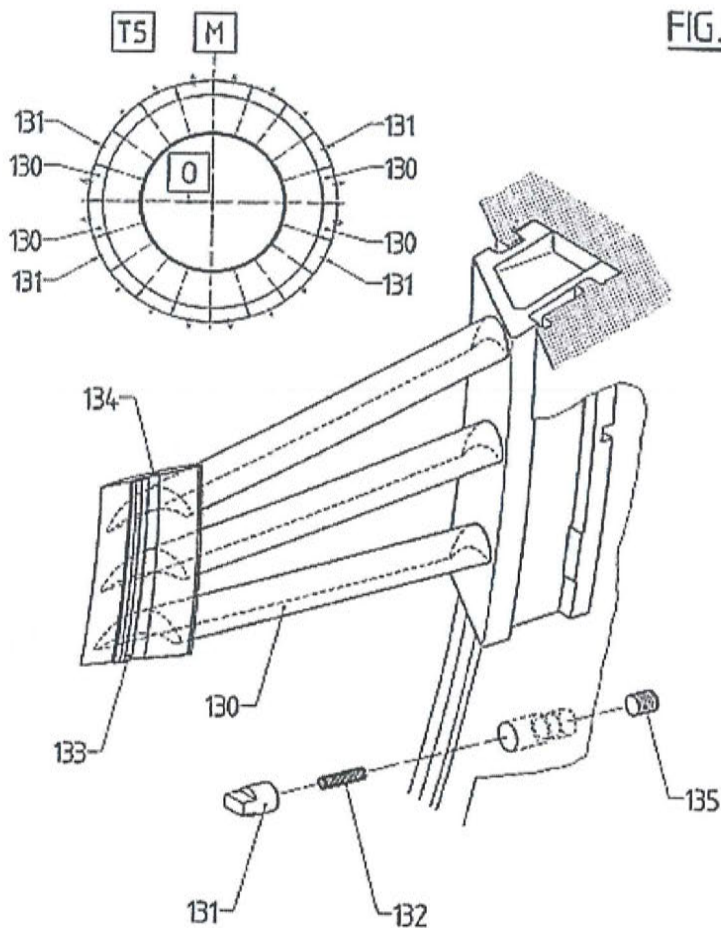


FIG.10

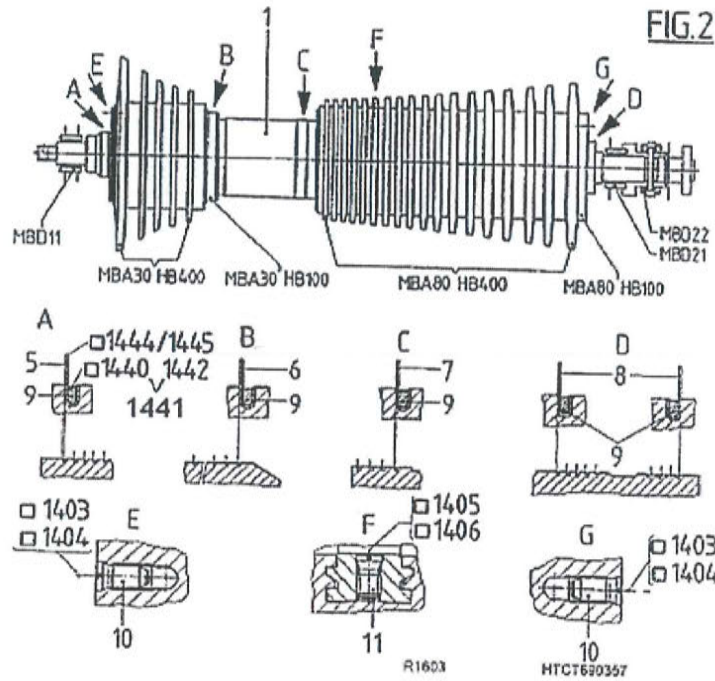


P8202

HTCT690372

Rotor		
Number	Pos. #	Description
HTCT 690 357	5	Seal Strip
HTCT 690 357	6	Seal Strip
HTCT 690 357	7	Seal Strip
HTCT 690 357	8	Seal Strip
HTCT 690 357	9	Wire
HTCT 690 357	30	Rotor HSS row A
HTCT 690 357	51	Axial Locker row A HSS
HTCT 690 357	44	Top Seal A - B
HTCT 690 357	29	Rotor HSS row B
HTCT 690 357	28	Rotor HSS row C
HTCT 690 357	43	Top Seal C - D
HTCT 690 357	27	Rotor HSS row D
HTCT 690 357	43	Top Seal D - E
HTCT 690 357	26	Rotor HSS row E
HTCT 690 357	25	Rotor HSS row F
HTCT 690 357	42	Top Seal F - G
HTCT 690 357	24	Rotor HSS row G
HTCT 690 357	23	Rotor HSS row H
HTCT 690 357	42	Top Seal H - I
HTCT 690 357	22	Rotor HSS row I
HTCT 690 357	21	Rotor HSS row K
HTCT 690 357	35	Segment Seal K - L
HTCT 690 357	36	Segment Seal K - L
HTCT 690 357	20	Rotor HSS row L
HTCT 690 357	31	Couling Piece L
HTCT 690 357	32	Couling Piece L
HTCT 690 357	33	Couling Piece L
HTCT 690 357	90	Turbine row 1 Blade
HTCT 690 357	92	Split shim
HTCT 690 357	93	Shim thin 1.5mm
HTCT 690 357	94	Shim thick 2mm
HTCT 690 357	37	Blade Root Seal
HTCT 690 357	128	Distance Washer 11X0.2mm
HTCT 690 357	128	Distance Washer 11X0.5mm
HTCT 690 357	128	Distance Washer 11X0.8mm
HTCT 690 357	129	Pressure Spring
HTCT 690 357		Welding Rod UTP 068 HH 2mm
HTCT 690 357	100	Turbine row 2 Blade
HTCT 690 357	102	Split Shim
HTCT 690 357	103	Shim thin 1.5mm
HTCT 690 357	104	Shim thick 2mm
HTCT 690 357	37	Blade Root Seal
HTCT 690 357	128	Distance Washer 11X0.2mm
HTCT 690 357	128	Distance Washer 11X0.5mm
HTCT 690 357	128	Distance Washer 11X0.8mm
HTCT 690 357	129	Pressure Spring
HTCT 690 357		Welding Rod UTP 068 HH 2mm
HTCT 690 357	110	Turbine row 3 Blade
HTCT 690 357	112	Split Shim
HTCT 690 357	113	Shim thin 1.5mm
HTCT 690 357	114	Shim thick 2mm

HTCT 690 357	37	Damping Strip
HTCT 690 357	128	Distance Washer 11X0.2mm
HTCT 690 357	128	Distance Washer 11X0.5mm
HTCT 690 357	128	Distance Washer 11X0.8mm
HTCT 690 357	129	Pressure Spring
HTCT 690 357		Welding Rod UTP 068 HH 2mm
HTCT 690 357	110	Turbine row 3 Blade
HTCT 690 357	112	Split Shim
HTCT 690 357	113	Shim thin 1.5mm
HTCT 690 357	114	Shim thick 2mm
HTCT 690 357	37	Damping Strip
HTCT 690 357	128	Distance Washer 11X0.2mm
HTCT 690 357	128	Distance Washer 11X0.5mm
HTCT 690 357	128	Distance Washer 11X0.8mm
HTCT 690 357	129	Pressure Spring
HTCT 690 357		Welding Rod UTP 068 HH 2mm
HTCT 690 357	120	Turbine row 4 Blade
HTCT 690 357	122	Split Shim
HTCT 690 357	123	Shim thin 1.5mm
HTCT 690 357	124	Shim thick 2mm
HTCT 690 357	37	Damping Strip
HTCT 690 357	128	Distance Washer
HTCT 690 357	128	Distance Washer
HTCT 690 357	128	Distance Washer
HTCT 690 357	129	Pressure Spring
HTCT 690 357		Welding Rod UTP 068 HH 2mm
HTCT 690 357	140	Turbine row 5 Blade
HTCT 690 357	141	Distance Washer
HTCT 690 357	145	Distance Washer
HTCT 690 357	142	Tension Disk
HTCT 690 357	143	Pressure Disk
HTCT 690 357	144	Dampening Pin
HTCT 690 357	38	Blade Root Seal
HTCT 690 357	39	Blade Root Seal
HTCT 690 357	40	Sealing Segment
HTCT 690 357	50	Axial Locker
HTCT 690 357	45	Flow deflection insert
HTCT 690 357		Welding Rod UTP068 HH 2mm



MBA30 HB400

FIG.3

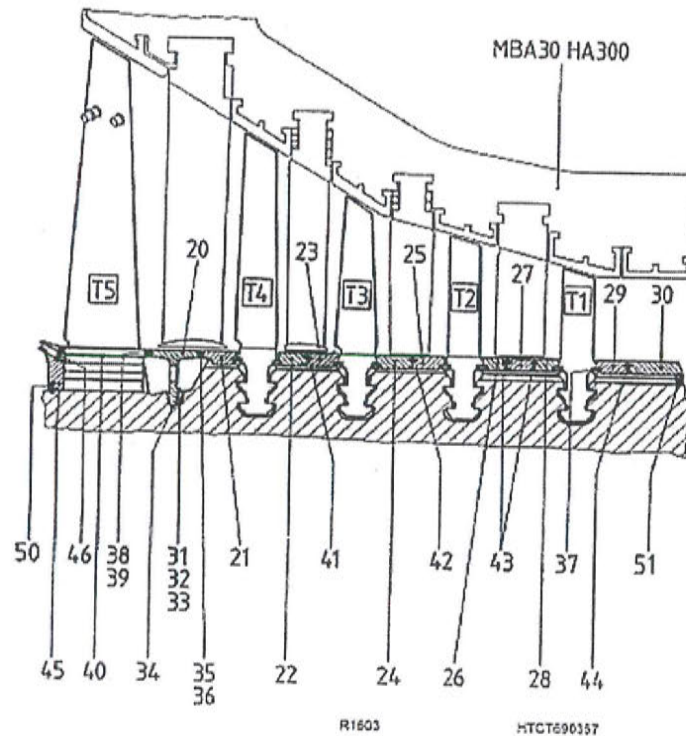


FIG. 5

	T1	T2	T3	T4
T	90	100	110	120
A	92	102	112	122
B	93	103	113	123
C	94	104	114	124

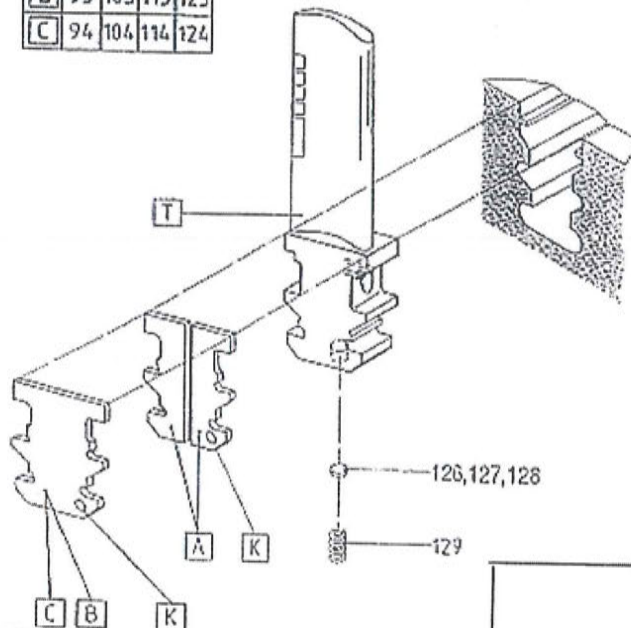


FIG. 4

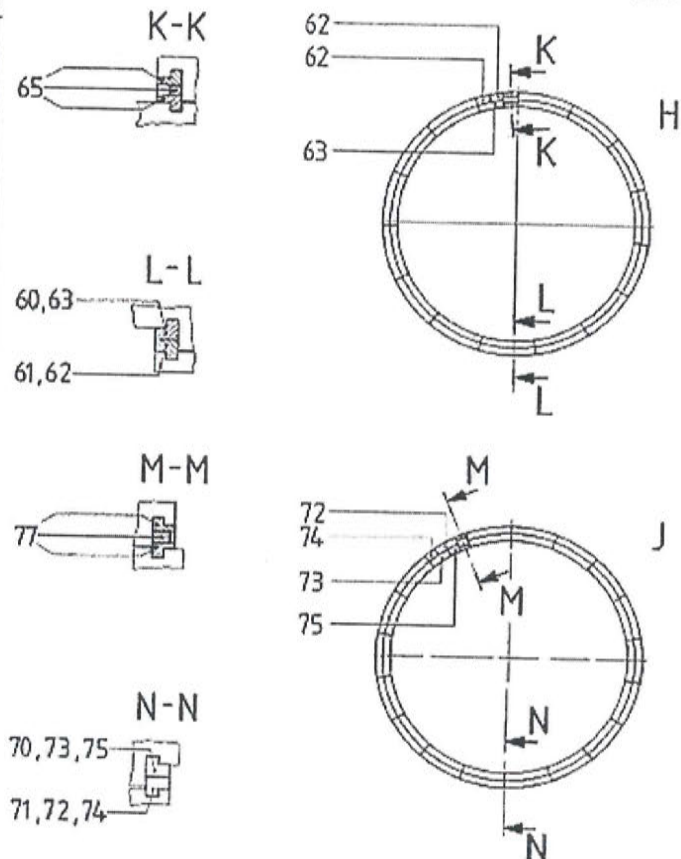
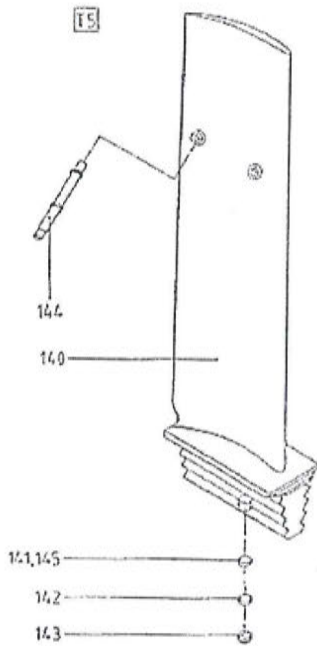


FIG. 6



R 1603

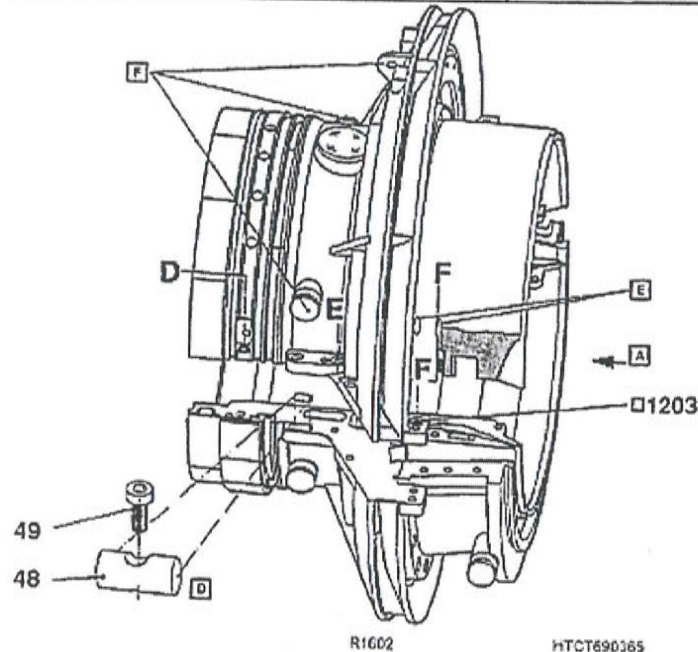
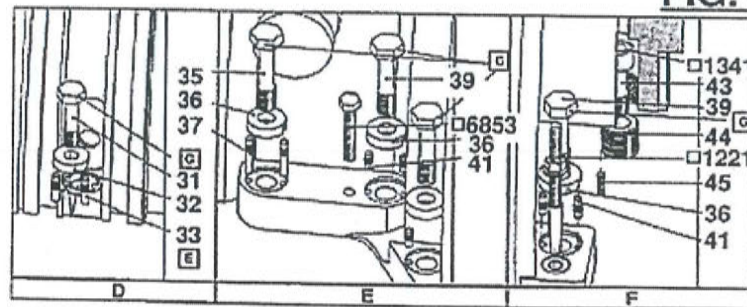
HTCC 690 357
10

20

Compressor Diffusor		
Number	Pos. #	Description
HTCT 690 365	11	Hex head bolt M24X90, diffuser split line
HTCT 690 365	12	Locking washer 24mm
HTCT 690 365	13	Pin 8X48
HTCT 690 365	14	Pin 8X38
HTCT 690 365	16	Hex head bolt M24X80, diffuser ring vertical flange
HTCT 690 365	20	Entry (Locking) Segment
HTCT 690 365	21	Hexagonal Head Bolt
HTCT 690 365	22	Filler Piece, right
HTCT 690 365	23	Filler Piece, left
HTCT 690 365	24	Pin
HTCT 690 365	25	Pressure Spring
HTCT 690 365	26	Pressure Bolt
HTCT 690 365	27	Safety Sleeve
HTCT 690 365	28	Pin
HTCT 690 365	29	Entry Segment
HTCT 690 365	31	Hex head bolt
HTCT 690 365	32	Locking washer
HTCT 690 365	33	Pin
HTCT 690 365	35	Hex head bolt
HTCT 690 365	36	Locking washer
HTCT 690 365	37	Pin
HTCT 690 365	39	Hexagonal Head Bolt
HTCT 690 365	41	Pin
HTCT 690 365	43	Hexagonal Head Bolt
HTCT 690 365	44	Threaded Casing
HTCT 690 365	45	Threaded Pin
HTCT 690 365	48	Round Key
HTCT 690 365	49	Hexagonal Socket Head Bolt
HTCT 690 365	51	Hexagonal Nut
HTCT 690 365	52	Lock Washer
HTCT 690 365	53	Gasket
HTCT 690 365	54	Hexagonal Head Bolt
HTCT 690 365	62	Locking Bolt
HTCT 690 365	67	Hex head bolt
HTCT 690 365	68	Locking washer
HTCT 690 365	69	Pin for locking washer
HTCT 690 365	71	Locking Bolt
HTCT 690 365	72	Locking Bolt
HTCT 690 365	80	Hexagonal Head Bolt
HTCT 690 365	81	Blind Flange
HTCT 690 365	82	Gasket
HTCT 690 365	85	Supply Line Assembly
HTCT 690 365	87	Hexagonal Head Bolt
HTCT 690 365	88	Vibration Damper
HTCT 690 365	95	Threaded Pin
HTCT 690 365	96	Segment
HTCT 690 365	97	Locking Segment, right
HTCT 690 365	98	Locking Segment, left
HTCT 690 365	99	Set of Segment
HTCT 690 365	100	Centering Bolt

HTCT 690 365	101	Pressure Spring
HTCT 690 365	102	Centering Bolt
HTCT 690 365	103	Tip Seal Segment

FIG. 4



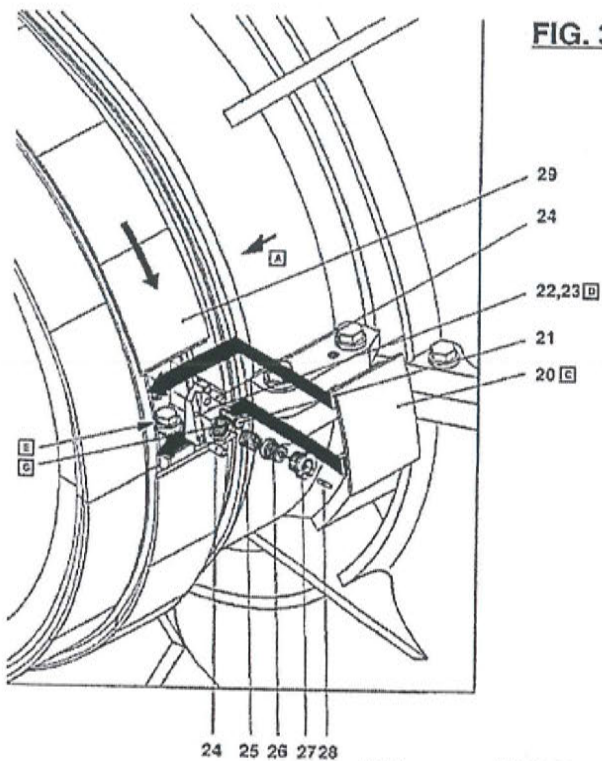


FIG. 3

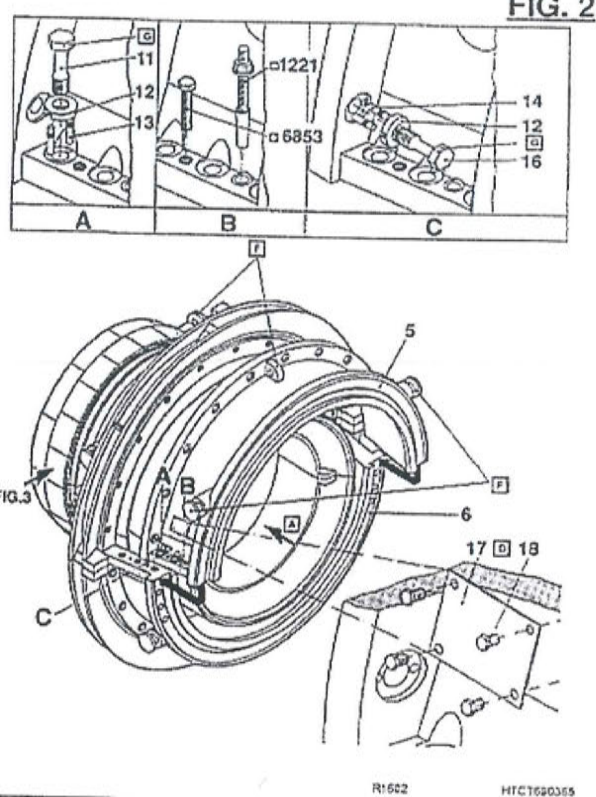


FIG. 2

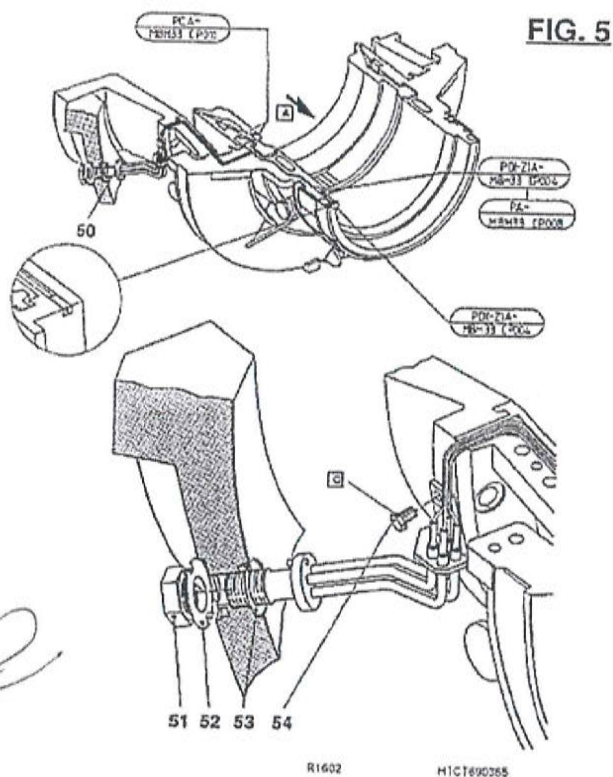


FIG. 5

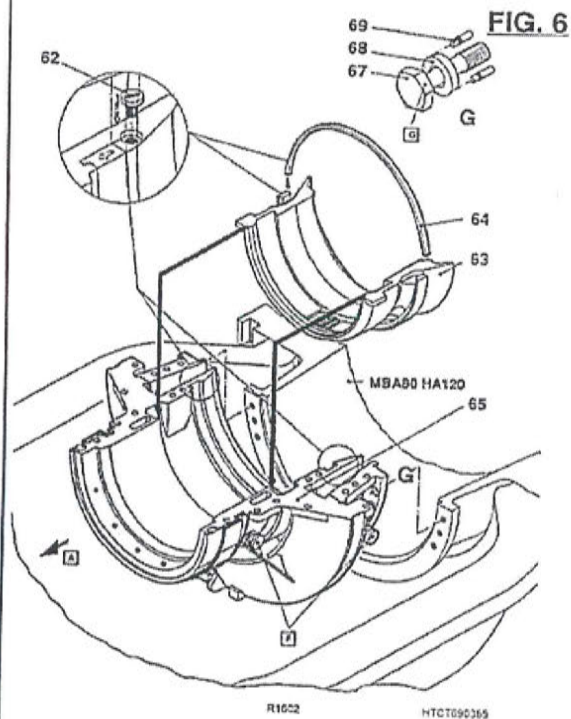
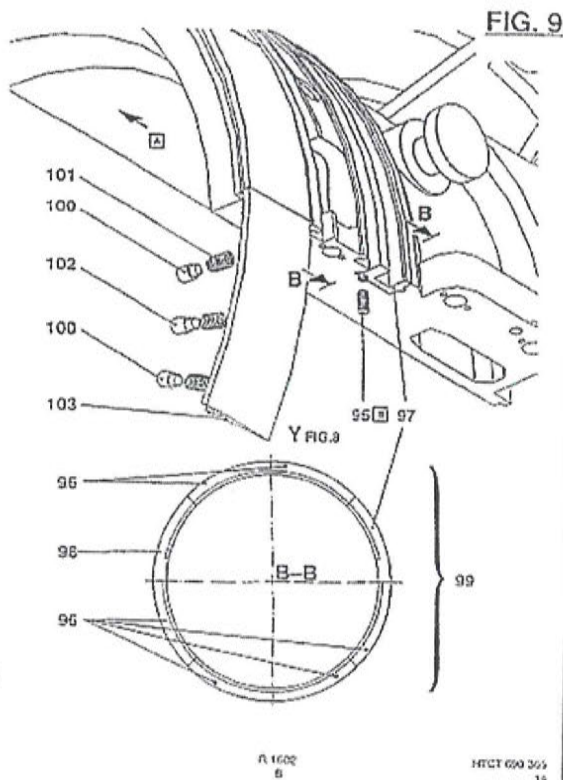
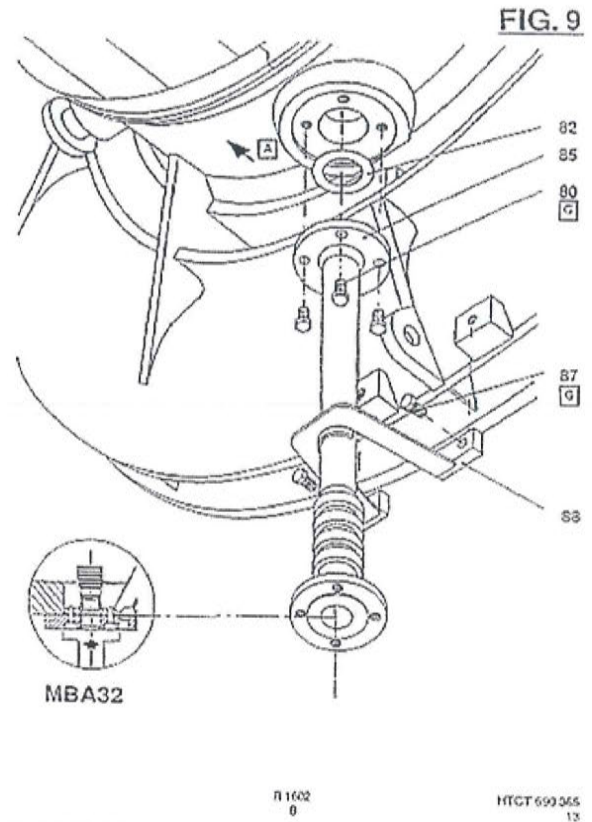
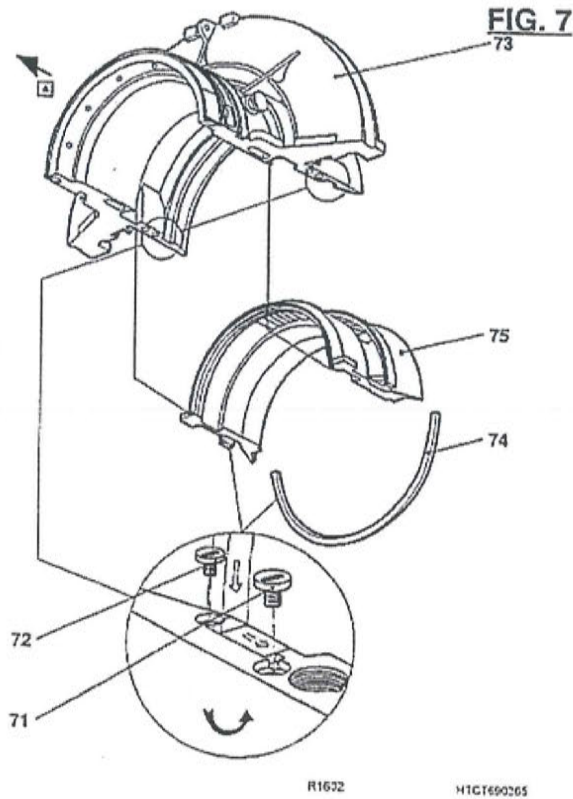


FIG. 6

W
PS





Power

Thermal Service – Gas Turbines

May 16, 2011

Puerto Rico Electric Power Authority
PO Box 364267
San Juan, Puerto Rico 009936-4267

ATTN: Ing. José W. Rivera Cacho
Director of Engineering-, Maintenance- and Technical Services
Division

RE: **Cambalache 1/2/3, 11N extension of TSM-23-03, Alstom Proposal
No. L 0359-F**


Dear: Ing. Rivera Cacho:

Alstom Caribe, Inc., ("Alstom") is pleased to present our revised proposal to provide one round of Scheduled C Inspections as an extension of the TSM-23-03 contract.

The information contained in this proposal and any contract formed as a result of this proposal is proprietary and confidential to Alstom and shall be retained by the recipient in confidence and shall not be published or otherwise disclosed to third parties without the express written consent of Alstom.


1. INTRODUCTION

Alstom herein offers to provide a proposed amendment to the current Hot Gas Path Parts agreement, TSM-23-03, whereby Alstom will provide one additional round of C Inspection Hot Gas Path Parts and services.

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Alstom Caribe, Inc. Turbine Division
An ALSTOM Company
2800 Waterford Lake Drive

Tel: 804-763-2124
Fax: 804-763-2193
Mobile: 804-539-3086



2. SCOPE OF WORK

One additional round of Scheduled C Inspections

The scope of the existing TSM 23-03 contract would be modified as follows:

- One additional round of scheduled 11N C inspections for a total of 6 rounds, for a total of 18 Class "C" inspections for the entire agreement, of which 10 Class "C" inspections have been executed as of the date of this offer. Term would be thru the earlier of December 31, 2023 or the completion of the 18th Class "C" inspection for the entire agreement.
- The supply of an on site operations and maintenance advisor would end on 12/31/2011.
- Hardware to upgrade existing GT control system i-historian and GMS for remote data collection.
- One TFA for scheduled GT A inspections up to a maximum of 6 consecutive days on site 12 hours per day per A inspection.
- Two TFAs (one mechanical one commissioning) for scheduled GT B inspections up to a maximum of 8 consecutive days on site 12 hours per day per B inspection.
- During the period while the maintenance advisor is on site, such person may act as one of the above-mentioned TFAs for Scheduled A and B inspections.
- Delivery of parts is not required for invoicing and payment of fees.

3. ASSUMPTIONS / CLARIFICATIONS

Alstom standards will be used for all manufacturing and repair operations, inspections and tests.

Existing LOC under TSM-23-03 will remain in place.

US customs duties are included. No other taxes, such as FONDO, OCIP, sales tax, and excise tax, etc. are included. FONDO will be invoiced at cost plus 15%.

PREPA to provide access and high-speed connection to GMS and i-historian for collecting of historical data before December 31, 2011.

HTCZ625425 Specification of Fuels for ALSTOM Gas Turbines equipped with Single Burner is applicable.

HTCT674987 Air Inlet System-Limits for Air Pollutants is applicable.

HTCT679046 Water Steam Quality to reduce NOX Emissions is applicable.

4. PRICING

For scope of supply contained in Section 2 the table of payments contained in the Second Amendment to TSM-23-03 would be replaced with the following table.

Invoice Date	Unit 1	Unit 2	Unit 3
1-Jul-03	\$564,618		
1-Oct-03	\$564,618	\$564,618	
1-Jan-04	\$587,118	\$587,118	\$587,118
1-Apr-04	\$587,118	\$587,118	\$587,118
1-Jul-04	\$587,118	\$587,118	\$587,118
1-Oct-04	\$587,118	\$587,118	\$587,118
1-Jan-05	\$610,293	\$610,293	\$610,293
1-Apr-05	\$610,293	\$610,293	\$610,293
1-Jul-05	\$610,293	\$610,293	\$610,293
1-Oct-05	\$610,293	\$610,293	\$610,293
1-Jan-06	\$634,163	\$634,163	\$634,163
1-Apr-06	\$634,163	\$634,163	\$634,163
1-Jul-06	\$634,163	\$634,163	\$634,163
1-Oct-06	\$634,163	\$634,163	\$634,163
1-Jan-07	\$658,750	\$658,750	\$658,750
1-Apr-07	\$658,750	\$658,750	\$658,750
1-Jul-07	\$731,581	\$658,750	\$658,750
1-Oct-07	\$731,581	\$731,581	\$658,750
1-Jan-08	\$753,528	\$753,528	\$753,528
1-Apr-08	\$753,528	\$753,528	\$753,528
1-Jul-08	\$753,528	\$753,528	\$753,528
1-Oct-08	\$753,528	\$753,528	\$753,528
1-Jan-09	\$776,134	\$776,134	\$776,134
1-Apr-09	\$776,134	\$776,134	\$776,134
1-Jul-09	\$774,706	\$776,134	\$776,134
1-Oct-09	\$774,706	\$774,706	\$776,134
1-Jan-10	\$801,572	\$801,572	\$801,572
1-Apr-10	\$801,572	\$801,572	\$801,572
1-Jul-10	\$801,572	\$801,572	\$801,572
1-Oct-10	\$801,572	\$801,572	\$801,572

Effective starting April 1, 2011, \$/ EOH payments would be made quarterly based on the EOH accumulated on each unit for the previous quarter times 418 \$/EOH. Starting January 1, 2012 and every subsequent January 1 the EOH fee would escalate 3% per year. Except for EOH payments for operation in excess of 16,000 EOH between Scheduled C inspection (which would be as defined in existing TSM-23-03), the \$/EOH payment would continue until a total of 66,000 EOH have accumulated on all 3 units in total from January 1, 2011.

Effective starting January 1, 2011 and thru the term, a quarterly fee of \$15,000 per unit per quarter payment would be made and escalated each year by 3%.

For example if the Cambalache GT units run 250 EOH per month on oil, per unit from Jan 1, 2011 to April 1, 2011, your quarterly EOH and Fee payment would be \$985,000 calculated as follows: Quarterly Fee = $(250 \text{ EOH} \times \$418) \times 3 \text{ units} \times 3 \text{ months} + (\$15,000 \times 3 \text{ units}) = \$985,000$ as compared to \$2,487,735 in the existing TSM-23-03.

After the units are commissioned on Natural Gas Fuel

- The EOH between scheduled C inspections is 24,000 EOH
- The fuel factor for oil firing is 1.5 and the EOH formula is per HTCT 690476 Rev G
- The \$/EOH fee is reduced to 2/3 of the current fee
- For the calculation of the timing of the next C inspection the EOH from the previous Scheduled C Inspection is multiplied by 1.5

For example if after conversion to natural gas the Cambalache GT units run on natural gas, 250 EOH per month per unit for a quarter, your quarterly payment would be \$672,000 in 2011 \$ calculated as follows: Quarterly Fee = $(250 \text{ EOH} \times \$418 \times 2/3) \times 3 \text{ units} \times 3 \text{ months} + (\$15,000 \times 3 \text{ units})$ as compared to \$2,487,735 in the existing TSM-23-03.

5. PAYMENT TERMS

All payments are due net 30 days after invoice.

See Section 4 above, for the Payment Schedule.

6. EXTRA WORK

In accordance with the terms contained in the existing TSM-23-03.

7. PROPOSAL VALIDITY

This proposal is valid until July 31, 2011, after which date this proposal, including the option, shall be invalid and automatically revoked. Notwithstanding the foregoing validity period, Alstom's pricing and schedule are conditioned on resource availability at the time the contract is signed by both parties. If resources are unavailable upon contract signature, Alstom reserves the right to adjust its price and/or schedule.

8. TERMS AND CONDITIONS

The sole governing terms and conditions that would govern shall be those set forth in a draft document entitled 'Amended and Restated Contract TSM-23-03 dated April 1, 2011' as discussed and modified by ALSTOM and PREPA in meetings at PREPA's Santurce offices on May 17, 2011 through May 19, 2011.

In case of conflicts between the terms contained in this proposal and the before mentioned terms and conditions, the terms stated in this proposal shall take precedence.

The terms and conditions contained herein, together with any additional or different terms offered elsewhere in this Alstom Caribe Inc., ("Alstom") Proposal, if any, constitutes Alstom's sole and exclusive offer with respect to the supply of equipment, parts, and services identified herein and all other offers which have been made for the scope proposed herein, whether oral or written, expressed or implied, are hereby revoked. This Proposal (i) supersedes all prior communications, both written and oral, between the parties; (ii) may not be modified in any manner without the express prior written agreement of Alstom; and (iii) shall not be subject to or interpreted under any prior written or oral communications (parole evidence), to the extent such communications conflict with this Proposal.

Acceptance by PREPA of this Proposal is expressly limited to and conditioned upon PREPA's acceptance of the Proposal in its entirety. Additional, inconsistent or different terms, conditions, or other requirements contained in (i) PREPA's

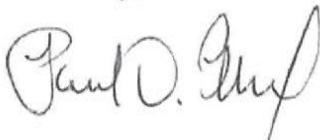
purchase order; (ii) other documents supplied or issued by PREPA; (iii) or oral authorizations of PREPA, all of which are made with the intent of establishing a Contract between Alstom and PREPA which is inconsistent with the terms of this Proposal, are hereby expressly rejected and shall be deemed a counter offer by PREPA.

9. PROPRIETARY STATEMENT

The information contained in this proposal and any contract formed as a result of this proposal is proprietary and confidential to Alstom and shall be retained by the recipient in confidence and shall not be published or otherwise disclosed to third parties without the express written consent of Alstom.

Alstom would like to thank you for providing the opportunity to support this project. If you have any questions, please contact your Alstom PREPA Service Manager, Peter Gebbs or Representative Ing. Aureo Alvarez, Sales Manager, IRI.

Sincerely,



Alstom Caribe, Inc.
Turbine Division
Paul Elkovich
Vice President
Turbine Generator Plant Services



Enclosure: Appendix 1 – Outage services

cc: Ing. Josue A. Colon, Head, PREPA Generation Director, Monacillos
Mrs. Magali J. Berrios Rivera, Administrator Operations and Infraestructore
Ing. Jaime A. Umpierre PE, Head Hydrogas – Cambalache Division Head, Monacillos
Mrs. Linette Alfonso, Head, Materials Management Division
Ing. Alejandro Adams, PREPA Plant Manager Cambalache
Ing. Julio Collazo, Mechanical Department Superintendent, Maintenance and Technical Services Division, PREPA Monacillos
Ing. Robert Betancourt, Project Manager Mechanical Department, PREPA Monacillos
Ing. Aureo Alvarez, Sales Manager, Isidro Ramos Inc.

APPENDIX 1 - OUTAGE SERVICES**1.0 SCOPE DESCRIPTION****1.1 SCOPE OF WORK**

ALSTOM will perform the scope of work specified by for a Class "C" Inspection on Cambalache Units # 1, # 2, and # 3. Except for craft labor and site personnel support which shall be furnished by PREPA at no cost or expense to ALSTOM as may be required to perform work (ALSTOM shall promptly advise PREPA of its support requirements as the become known), the scope of work includes the following:

- Mobilize and setup office, tools, receive, uncrate, clean and prepare all outage parts. TFA will check warehouse spare parts inventory.
- Locate, check and prepare all OEM tools at the site.
- Purchase, organize and identify all consumables to be used during the work. Transmit copies of MSDS to PREPA's Environmental Engineer.
- Conduct pre job safety orientation of ALSTOM Staff with PREPA's Engineer present.
- Remove combustor enclosure roof
- Remove burner, dismantle inspect and test fuel nozzle assembly.
- Remove combustor enclosure tower halves.
- Remove combustion chamber piping
- Remove combustion chamber
- Remove and safely store the original insulation blankets of thermal block
- Disassemble inspect, reassemble the combustion chamber
- Remove blow off valve and silencer
- Dismantle, clean inspect blow off valves.
- Remove air intake elbow.
- Remove air intake manifold
- Loosen bolts gas turbine casing
- Remove gas turbine casing
- Remove hot gas casing upper part
- Remove gas turbine vane carrier upper part
- Remove compressor diffuser upper part
- Remove bearing covers
- Remove rotor, deblade HGP Parts as requires, cleaning and NDE
- Perform C Inspection HGP Parts Blading work scope
- Remove vane carrier, lower part
- Remove and store GT belly piping.
- Clean and inspect GT casing halves.


GT Hot Gas Path Protection Plan,**Proposal No. L0359-F**

- Install rotational carrier, lower part
- Install rotor, alignment check
- Vane and blade tip grinding
- Final install rotor after cleaning grinding debris from lower casing.
- Install compressor diffuser and vane carrier, upper part
- Install hot gas casing upper part
- Install gas turbine outer casing, torque bolts
- Install insulation blankets of thermal block (supplied by PREPA)
- Install air intake manifold and air intake elbow
- Install blow off valve and sound damper
- Assemble combustion chamber
- Install roof panels
- Install combustion chamber
- Install combustor piping
- Install combustor enclosure
- Motor roll / install burner
- Reconnect all piping associated with burner, install all insulation components afterward.
- Install combustor enclosure roof
- Start up unit in coordination with and assisted by PREPA Operations Personnel.
- Monitor the overhauled unit for vibration.
- Provide balancing if required.

1.2 EXTRA WORK

In general, the definition of "extra work" is to be taken in context with the scope of this proposal. If the proposal work description is very detailed, extra work can be defined as "work, which was not included in the defined Scope of Work." If the scope is not defined specifically as to each and every step, then "extra work" is to be defined as "repair of discrepancies, the existence of which would be unknown until disassembly, cleaning and inspection was completed." We have included "minor" blending, deburring, grinding and lapping in our packaged outage proposal.

ALSTOM will not proceed to perform any extra work without PREPA's approval. A written Extra Work Authorization, to perform extra work, will be issued by ALSTOM Site Project Manager for signature by PREPA. PREPA will receive a copy of the Extra Work Authorization. Extra work will be billed at ALSTOM rate sheets, see Attachments.



Extra work may require the services of other subcontractors, which will be determined at the time the extra work is identified. All costs for ALSTOM provided / organized on / off site subcontract work will be invoiced on Time & Material ("T&M") in accordance with ALSTOM rate sheets, see Attachments.

Schedule or work delays, due to work subcontracted by PREPA may result in additional charges, i.e. standby or mobilization / de-mobilization charges. Extra work may adversely effect outage duration.

1.3 PERSONNEL AND FACILITIES / EQUIPMENT**1.3.1 ALSTOM Personnel**

ALSTOM's scope shall be limited to no more than:

- Site manager
- Two Superintendents
- One Expeditor
- One Office manager
- Two mechanical TFAs
- One Balancing engineer
- One commissioning engineer
- Two Bladers (if needed)
- NDE subcontractor
- One Tool room manager
- One Janitor.
- One Driver/runner
- Tools, rental equipment, site facilities, consumables as described in our offer.

1.3.2 Craft Personnel

- PREPA shall provide all skilled craft labor including personal protective gear as required to support the work

1.3.3 Facilities and Equipment provided by ALSTOM

- Two (2) trailers for office facilities,
- One (1) trailer for craft labor break room
- Blade and vane tip grinder
- Consumables
- Job-site pickup truck
- Safety equipment
- Office supplies, Xerox machine and service of same
- Welding rod
- Parts cleaning (solvent washer type) stations
- Chemical toilets
- Lumber and weather protection
- Air compressor and welding machine.
- Aluminum Oxide blasting equipment.
- Complete tool trailer manned by a trained attendant,
- Containers for consumables and small parts.
- Thirty (30) ton Cherry picker for mobilization and demobilization.
- Five (5) ton fork truck for daily use during the outage
- Manlift equipment to access the roof area and intake elbow bolts.

GT Hot Gas Path Protection Plan,**Proposal No. L0359-F**

- Portable Machine Shop Container

1.3.4 Other Services

- Grit Blast Cleaning equipment for cleaning of small parts on site.
- Non Destructive Examination ("NDE") associated with HGP Parts and scheduled inspections

2.0 CLARIFICATIONS

- 2.1 PREPA will provide site and equipment security coverage 24 hours per day seven days per week during the outage. All breaches of such security will be responsibility of and to the account of PREPA. In addition ALSTOM shall have the right to monitor operation the units and the outages, but this shall in no way relieve PREPA of their responsibility relative to site security.
- 2.2 ALSTOM's TFAs will be allowed to personally take critical measurements, and may find it necessary from time to time to perform certain "hands on work". These occasions are at the TFA's discretion in every case.
- 2.3 ALSTOM's Factory trained BLADING SPECIALISTS will perform "hands on work" as in the past, and will be given hands on assistance as required and when required by PREPA supplied craftsmen.
- 2.4 ALSTOM's SUPERINTENDENTS will perform "hands on work" as in the past, and will be given hands on assistance as required and when required by PREPA supplied craftsmen. In addition, they will provide consultation on all heavy rigging operations.
- 2.5 ALSTOM's CERTIFIED INCONEL WELDING SPECIALIST will perform "hands on work" as in the past, and will be given hands on assistance as required and when required by PREPA supplied craftsmen.
- 2.6 ALSTOM will have available the basic "tools of the trade" for Millwright type work as practiced in the past. ALSTOM's tool room manager employs a tool tracking / signing system to maintain company tools. All persons on site are to cooperate in this process.
- 2.7 PREPA Craft personnel will remove and reinstall thermal insulation. Any non-repairable insulation blankets and insulation TFA to be supplied by PREPA.
- 2.8 The proposed schedule commences after the GT exhaust temperature is less than 140 Deg. F. allowing the unit to be taken off rotor barring.
- 2.9 Craft electrical work, and material as well as I&C Technician labor, is not included. PREPA will provide electrical and instrument technicians with tools and instruments as required to accomplish the work scope.
- 2.10 Monitoring for and removal / disposal of all hazardous materials such as materials containing asbestos, lead carbonates etc. is not included.

GT Hot Gas Path Protection Plan,**Proposal No. L0359-F**

- 2.11 Removal and reinstallation of fire protection, including instrumentation, conduit and piping, is not included.
- 2.12 Removal of bolts, studs, pins, keys and other parts by burning, freezing, drilling, machining or by other abnormal means shall be performed on a cost plus T&M basis. In such a case, ALSTOM would clearly state the need to do so, for the decision of PREPA's Engineer.
- 2.13 PREPA will make available any and all required spare parts except for parts included in this agreement. Lack of spare parts when needed may delay completion of work and adversely impact the "ready for motor roll" date. Any such delay will be billed to PREPA on a cost plus T&M basis. PREPA will ensure that the warehouse shall be open during daytime hours, 7: 00 AM to 6:00 PM, six (6) days per week to support ALSTOM's schedule during the C Inspection.
- 2.14 All special Original Equipment Manufacturer ("OEM") tools including rigging fixtures, rotor stands, burner stand, hydraulic bolt tensioners etc. for the Gas Turbine are to be provided by PREPA and in good working condition. All Normal hand tools, typically used for millwright work, will be provided by ALSTOM.
- 2.15 PREPA will ensure that the overhead crane is maintained in good working order / certified and is made available to ALSTOM on a priority basis. However, with sufficient advance notice, when the critical path schedule allows, ALSTOM will share use of the crane for PREPA's need's price is based on operation of the crane by capable supplied personnel. PREPA will furnish on an expedited basis, any large supplemental cranes that may be required in the event of station crane breakdown.
- 2.16 In order to assure effective communication and timely response to project needs, it is expected that PREPA will provide Plant Operations personnel, who are dedicated to the same working hours for assistance during the outage. PREPA and ALSTOM will each provide persons for interfacing, with authority to represent their companies during the time ALSTOM is performing the scope of work.
- 2.17 The craft manpower loading and work schedule may change, as required by the work scope, inspection findings.
- 2.18 Rotating and stationary component repair, other than minor blending as specified in 1.2, EXTRA WORK, is not included in the price. ALSTOM can offer repair as an option and, dependent on requirements, can either complete the repair on site, or ship parts to one of ALSTOM's authorized workshops.
- 2.19 PREPA will remove and replace lubricating oil and control fluid, and diesel fuel if required. PREPA will provide necessary jumpers / fittings to complete a lube oil flush, if required. PREPA Maintenance Personnel will perform any and all routine maintenance of the intake filter house, thermal block components, fuel system and hydraulic system pumps, valves, and other components separately from the C inspection work scope. In the event that a flushing of the closed cooling water system is required, PREPA will provide any and all specialty contractors with the equipment and consumables needed to accomplish cleaning of the system. PREPA will fabricate any piping jumpers and labor to handle placement of blanks etc. This flushing shall be performed separately from the "C" Inspection work scope, and shall be managed by

PREPA in such a way that this is completed within the time frame allowed during "C" Inspections.

- 2.20 ALSTOM will ensure that the ALSTOM Staff attends PREPA's Safety orientation as is normally conducted on site prior to an outage. When mobilized on site, ALSTOM will conduct a weekly safety meeting with all its employees. PREPA's Engineer is invited to attend.
- 2.21 ALSTOM will provide Grit Blast Cleaning cabinets and NDE services on the site, as done during the past. There is no plan or provision to ship any component off site for cleaning or other work.
- 2.22 Please see the attached **RESPONSIBILITIES CHECKLIST**, which expands on PREPA's and ALSTOM's scope of supply during scheduled "C" Inspections.
- 2.23 ALSTOM will not perform any extra work without PREPA's written approval. A sample **EXTRA WORK AUTHORIZATION** is attached. Billing for extra work services will be as per ALSTOM's published rate sheets in effect at the time the work is performed on a cost plus T&M basis, and will be discussed and agreed to with PREPA in advance. Extra work may adversely effect the outage duration.
- 2.24 Checking of coupling alignment is included in the scope of this proposal. Major Realignment, if required, shall be performed cost plus T&M basis and could adversely affect the outage duration.
- 2.25 After ALSTOM has mobilized, our TFA and Site Manager are available as necessary to meet with PREPA to work out details of the C Inspection day to day activities. ALSTOM will attend the normal weekly progress meeting, and issue a weekly written report and updated schedule at that time each week.
- 2.26 ALSTOM is included in PREPA's "OCIP" Insurance Policy.
- 2.27 FONDO Insurance Policy during the "A", "B" and "C" inspections will be provided to PREPA at cost plus 15%.
- 2.28 ALSTOM requires parking space inside the plant for up to 9 persons daily at maximum strength.
- 2.29 ALSTOM wishes to be allowed the limited use of PREPA's sanitary facilities in the locker room. ALSTOM will assign a person to clean up the facility daily. ALSTOM will provide chemical toilets in the work areas as well.
- 2.30 PREPA shall provide nighttime security of the entire work area.
- 2.31 ALSTOM will provide direction to PREPA craft regarding the proper reassembly of the GT enclosure, roof panels, wall panels etc. after the overhauls. PREPA and its subcontractors will address the final weather proofing of enclosure roofing and flashings for long-term service after the "C" Inspections.
- 2.32 Preliminary scheduling of C inspections shall begin one (1) year in advance and revisited on a periodic basis. ALSTOM requires 12 weeks advance notice prior to setting the final start date of a Scheduled C inspection for prejob activities, shipping of

GT Hot Gas Path Protection Plan,**Proposal No. L0359-F**

tools and parts. For outages that occur back to back, ALSTOM requires approximately seven (7) days between the end of the first and commencement of the next "C" Inspection.

ATTACHMENTS

1. Responsibilities Check List
2. Extra Work Authorization (Sample)
3. ALSTOM Schedule of Rates for Jobsite Management Services
4. ALSTOM Schedule of Rates for Field Advisors
5. ALSTOM Schedule of Field Equipment Rental Rates
6. ALSTOM Schedule of Rates for Maintenance Tools, Materials and Subcontractors
7. ALSTOM Schedule of Rates for Jobsite Craft Labor Services
8. Hot Gas Path Parts GT11N1 Standard Combustor Cambalache
9. HTCZ621425 Specification of Fuels for ALSTOM Gas Turbines equipped with Single Burner
10. HTCT674987 Air Inlet Systems-Limits for Air Pollutants
11. HTCT679046 Water Steam Quality to reduce NOX Emissions



Attachment 1

RESPONSIBILITY CHECKLIST

Cost and arrangements to provide the items listed are the responsibility of ALSTOM, Owner or Not Applicable as indicated by an "X" in the appropriate column below:

	TOOLS	ALSTOM	PREPA	N/A
1	Non specialty standard and metric mechanics hand tools	X		
2	Pipefitter tooling	X		
3	Non specialty lifting and rigging tools, slings, shackles, chain hoists	X		
4	Hydraulic and mechanical jacks, rams and pumps	X		
5	Precision / measuring tooling, calibrated tools	X		
6	Electric tools, supplementary lighting and extension cords	X		
7	Hytorq, hydraulic torque wrenches	X		
8	ITH / Hydratight hydraulic bolt tensioning devices and pumps		X	
9	Bladers tool box	X		
9a	Winders tool boxes			X
10	Commissioning tools	X	X	
11	Pneumatic tools, air hoses, nozzles & fittings	X		
12	Borescopic equipment	X		
13	Optical level	X		
14	EIC / BBC consumable boxes			X
	OTHER EQUIPMENT	ALSTOM	PREPA	N/A
15	Rotor and casing stands		X	
16	Welding / brazing / burning / cutting equipment	X		
17	Forklifts, man lifts, mobile cranes, flat bed trailers/trucks, only for mob. / demob. of ALSTOM	X		
18	Special OEM tools, slings, fixtures, devices		X	

Attachment 1

19	Overhead crane, crane inspection & service		X	
20	Oil flushing equipment		X	
21	Rotor / casing transportation skids			X
22	Compound slide / machining base block			X
23	Power rollers			X
24	Generator winding equipment			X
25	Generator diagnostic equipment			X
26	Blade tip grinding, labyrinth seal cutting equipment, compound slide	X		
27	Safety equipment, signs and barricades	X	X	
	CONSUMABLES	ALSTOM	PREPA	N/A
28	Non HAZMAT consumables (rags, bits, files)	X		
29	HAZMAT consumables (solvents, lubricants, paints)	X		
30	Cribbing, lumber, blocking, plywood	X	X	
	SERVICES	ALSTOM	PREPA	N/A
31	Removal & reinstallation electrical plant equipment		X	
32	Removal & reinstallation Plant instrumentation		X	
33	Removal & reinstallation blanket insulation		X	
34	Removal & reinstallation other type insulation		X	
35	Supply, install, inspect, remove scaffolding		X	
36	Connect / disconnect ALSTOM electrical items to Plant services		X	
37	Off Site Machine shop services		X	
38	Liaison personnel between ALSTOM and Customer	X	X	
39	Project schedule and schedule updates	X		
40	Crane operators		X	
41	Housekeeping, work area cleanliness	X	X	
42	Confined space permitting and monitoring		X	
43	General work permits, hot work permits		X	

Attachment 1

44	Non destructive testing (NDT & supplies)	X		
45	Blast clean services and supplies	X		
46	Waste disposal, trash bins, containers		X	
47	HAZMAT disposal and receptacles		X	
48	Receiving, loading, unloading of materials prior to ALSTOM mobilization		X	
49	Receiving, loading, unloading of materials after ALSTOM mobilization	X	X	
50	Monitoring, removal, disposal of Asbestos		X	
51	Lube oil purification, drain tank, cleaning of reservoir		X	
52	Removal and installation of fire protection / detection equipment		X	
53	Induction heating			X
54	Balancing and balancing equipment	X		
	GENERAL SUPPLIES	ALSTOM	PREPA	N/A
55	Supply electrical power (120V, 480V)		X	
56	Compressed air and service water		X	
57	Potable water	X		
58	Replacement parts other than covered under the HGPPP		X	
59	Repair of parts other than covered under the HGPPP		X	
60	Technical drawings, data sheets, parts list	X		
61	Oxygen, acetylene, argon, propane, etc.		X	
62	Supply replacement insulation & blankets GT and Compressor casing		X	
	INFRASTRUCTURE	ALSTOM	PREPA	N/A
63	Office facilities	X		
64	Sanitary facilities	X		

Attachment 1

65	Parts storage and storage bins	X		
66	First aid facilities	X	X	
67	Emergency rescue plan		X	
68	Safety procedures	X	X	
69	Change shelter for labor	X		
70	Foreign materials exclusion (FME) plan	X	X	
71	Lay down area and plans	X		
72	Telephone, fax, internet access, hookups	X		
73	Work tables, bench grinders, bench vices	X		
74	Fire extinguishers	X	X	
	OTHER	ALSTOM	PREPA	N/A
75	Tooling transportation changes	X		
76	Material transportation charges not part of HGPPP Services scope		X	
77	Payment of local taxes and permits		X	



Attachment 2

EXTRA WORK AUTHORIZATION

Proposal No. L-0359-F 5/16/11

GENERAL INFORMATION

CUSTOMER: _____

CUSTOMER PO / CONTRACT NUMBER: _____

SITE NAME: _____

ALSTOM PROJECT NUMBER: _____

EWA IDENTIFICATION NUMBER: _____

ALSTOM W/O NUMBER: _____

DATE: _____

2. SCOPE OF ADDITIONAL WORK:

* Labor	_____	\$0
* Expenses / Rental	_____	\$0
* Subcontractor / Supplier	_____	\$0
* Materials	_____	\$0
TOTAL	_____	\$0

ALSTOM Power's Price is:

(Check One)

Firm ☒ X

Estimated Time & Material _____

4. IMPACT ON SCHEDULENew schedule attached? ☐ Yes ☒ No**5. REMARKS**

The estimated time and material price for this proposed Extra work, as quoted above, does not include costs for delays to the overall schedule and scope, in the event that the extra work scope should cause such delays. Delays may occur due to an impact of this work to the scheduled critical path work activities, or due to unavailability of parts or special OEM tooling required for this extra work. There are no parts of any kind included in this estimated at the time of this occurrence.

By signing this Extra Work Authorization, the Customer authorizes the above work to be performed subject to the price and/or schedule adjustment(s) set forth herein. Except as stated herein, the terms and conditions of the original purchase order remain in full force and effect.

ISSUED BY: _____

ACCEPTED BY: _____

ALSTOM REPRESENTATIVE: _____

DATE: _____

CUSTOMER'S REPRESENTATIVE: _____

DATE: _____

2011
SCHEDULE OF RATES FOR JOBSITE MANAGEMENT SERVICES
FOR PUERTO RICO ELECTRIC POWER AUTHORITY (PREPA)

These services are provided by **ALSTOM** Caribe, Inc., Turbine Division., an ALSTOM Company, for equipment supplied by ALSTOM Power Inc., and its predecessors ABB ALSTOM Power Inc., ABB Power Generation Inc., and Brown Boveri Power Equipment Inc., and installed in Puerto Rican facilities. Jobsite Services are offered in three categories for craft labor management and support during installation, inspection, investigation, test, measurement, overhaul, and maintenance.

RATE SCHEDULE¹

ATTACHMENT 3

DESCRIPTION	Daily ^{2,3} /Day	Overtime ⁴ /Hour	Doubletime ⁵ /Hour
Jobsite Project Manager, employed on larger projects where the complexity of the installation requires at least two shift superintendents or when multiple shifts will be worked.	\$1,894	\$354	\$472
Jobsite Superintendents, specialists in various disciplines such as turbine erection, piping installation, condenser rebuild, etc.	\$1,073	\$201	\$268
Schedulers, full or part time scheduling specialists experienced in Primavera Finest Hour or other full scale CPM programs including software and computer equipment.	\$1,774	\$219	\$292
Office Staff, office managers, timekeepers, clerks etc. These personnel may be assigned to the jobsite at the owners request or will be assigned as part of the regular staff on large projects:			
Office Manager	\$544	\$102	\$136
Expediter	\$464	\$87	\$116
Tool Keeper	\$792	\$148	\$198

Note:

1.	All Rates are subject to a MINIMUM BILLING requirement of "4 HOURS" (if less than four (4) hours worked or traveled; "8 Hours" if more than four (4) hours but less than eight (8) hours worked) Plus applicable TRAVEL EXPENSES, RENTAL CHARGES and PER DIEMS as specified below.
2.	"Assignment Preparation And Demobilization" Preparation time not to exceed eight (8) hours and demobilization charged per actual hours worked. Customer imposed special report preparation requirements will also be subject to these rates.
3.	"Straight Time" First eight (8) hours worked during regular hours Monday through Friday and customers recognized holidays that differ from ALSTOM's whether worked or not.
4.	"Overtime" Hours worked or traveled in excess of regular eight (8) hour workday, Monday through Friday; and all day Saturday or Sunday and hours worked or traveled on ALSTOM Recognized Holidays (ALSTOM recognized Holidays vary by year but typically include New Years Day, Day After New Years and / or Day After Christmas, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas Eve and / or New Years Eve, Christmas Day)
5.	"Double Time" Hours worked all day Sunday and ALSTOM Recognized Holidays
6.	No local Puerto Rican taxes are included in the above rates, FONDO Policy will be invoiced at cost plus 15%, Customer to provide office space, break-, rest room facilities and internet connection.

**** In addition to the above RATE SCHEDULE, travel, living and miscellaneous expenses are charged as follows:**

PER DIEM	Calculated from day of departure through and including the day of return. Per Diem covers meals, local travel and transportation, miscellaneous ordinary living expenses and lodging. Per Diem will be invoiced based on the applicable range of local lodging expenses as follows:		
Per Diem	Lodging Expenses	Per Diem	Lodging Expenses
\$140	per day with no local lodging expense; or	\$621	per day with local lodging expense \$341.01-\$380; or
\$216	per day with local lodging expense \$1-\$60; or	\$671	per day with local lodging expense \$380.01-\$420; or
\$266	per day with local lodging expense \$60.01-\$100; or	\$722	per day with local lodging expense \$420.01-\$460; or
\$317	per day with local lodging expense \$100.01-\$140; or	\$773	per day with local lodging expense \$460.01-\$500; or
\$367	per day with local lodging expense \$140.01-\$180; or	\$824	per day with local lodging expense \$500.01-\$540; or
\$418	per day with local lodging expense \$180.01-\$220; or	\$874	per day with local lodging expense \$540.01-\$580; or
\$468	per day with local lodging expense \$220.01-\$260; or	\$925	per day with local lodging expense \$580.01-\$620; or
\$519	per day with local lodging expense \$260.01-\$300; or	\$976	per day with local lodging expense \$620.01-\$660; or
\$570	per day with local lodging expense \$301-\$340; or	\$1,026	per day with local lodging expense \$660.01-\$700.
	Proof of lodging expense (copy of lodging invoice) will be provided with first invoice and anytime during assignment that such expense changes. Lodging expense is the sum of the room cost plus all applicable taxes.		
TRAVEL	From point of origin to jobsite and return travel. Travel expense includes (i) travel time at the applicable Class Rate A, B, or C, and (ii) travel expenses as follows:		
	1. Airfare, taxis, limos, tolls and parking at actual cost plus personal auto transportation; or		
	2. Vehicles : Personal @ the allowed IRS mileage rate.		
RENTAL	In accordance with the Rates set forth in the ALSTOM "Schedule of Rates for In-Shop Services" and "Field Services And Equipment Rental Rates" in effect at the time Services are performed. All materials, transportation, shipping, special tools, fixtures, or non-ALSTOM support required to complete the Services shall be provided at ALSTOM's cost plus 25%.		

The rates contained herein are effective January 1, 2011, and are subject to ALSTOM Power Inc. "Terms and Conditions for Service" in effect on the date the order is received. Rates are subject to change without notice.

ALSTOM

2011 Schedule of Rates for Field Advisors For Puerto Rico Electric Power Authority (PREPA)

The following services are offered by **ALSTOM** Caribe, Inc., Turbine Division, an ALSTOM Company. Services are offered in three (3) categories/classes covering technical advice during installation, inspection, investigation, test, measurement, overhaul, and maintenance of turbine equipment formerly supplied and serviced by ABB Power Generation Inc., ABB ALSTOM Power Inc., and others, and installed within the continental U.S.A., Caribbean and Puerto Rico (excluding Hawaii).

RATE SCHEDULE (See Notes 1 & 6)

ATTACHMENT 4

Class	Description	Straight Time Rate Per Hour (See Note 3)	Overtime Rate Per Hour (See Note 4)	Double Time Rate Per Hour (See Note 5)
A	Specialized Advisors; Senior Commissioning Technicians, Lead Technical Advisors (Lead TFA, Outage Lead TFA, Night shift Lead TFA, Lead TFA for "A/B" inspections); and factory based consultants for Performance Evaluation, Vibration, Condition Assessment, etc.	\$248	\$372	\$496
B	Advisors and Technicians with a high level of experience and training, including the specialties of Commissioning, Electronic/I&C, T/G Erectors/Installation, Stainless Steel Coating, etc.	\$213	\$319	\$426
C	Bladers, Winders, Welders, Flame Sprayers, Q. C. Inspectors, Machinist, Assemblers, etc.	\$198	\$297	\$396

NOTES:

- All Rates are subject to a **MINIMUM BILLING** requirement of "4 HOURS" If less than four (4) hours worked or "8 Hours" if more than four (4) hours but less than eight (8) hours worked; Plus applicable **TRAVEL EXPENSES, RENTAL CHARGES** and **PER**
- "Assignment Preparation And Demobilization"** Preparation time not to exceed eight (8) hours and demobilization charged per actual hours worked. Customer imposed special report preparation requirements will also be subject to these rates.
- "Straight Time"** First eight (8) hours worked during regular hours Monday through Friday and customers recognized holidays that differ from ALSTOM's whether worked or not.
- "Overtime"** Hours worked or traveled in excess of regular eight (8) hour workday, Monday through Friday and all day Saturday; and hours traveled all day Sunday and on ALSTOM Recognized Holidays (ALSTOM recognized Holidays vary by year but typically include New Years Eve, New Years Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Day after Thanksgiving, Christmas Eve, and Christmas Day)
- "Double Time"** Hours worked all day Sunday and ALSTOM Recognized Holidays (ALSTOM recognized Holidays vary by year but typically include New Years Eve, New Years Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Day after Thanksgiving, Christmas Eve and Christmas Day)
- No local Puerto Rican taxes are included in the above rates, FONDO Policy will be invoiced at cost plus 15%, Customer to provide office space, break-, rest room facilities and internet connection

In addition to the above RATE SCHEDULE, travel, living and miscellaneous expenses are charged as follows:

PER DIEM Calculated from day of departure through and including the day of return. Per Diem covers meals, local travel and transportation, miscellaneous ordinary living expenses and lodging. Per Diem will be invoiced based on the applicable range of local lodging

Per Diem	Lodging Expenses	Per Diem	Lodging Expenses
\$140	per day with no local lodging expense; or	\$621	per day with local lodging expense \$341.01-\$380; or
\$216	per day with local lodging expense \$1-\$60; or	\$671	per day with local lodging expense \$380.01-\$420; or
\$266	per day with local lodging expense \$60.01-\$100; or	\$722	per day with local lodging expense \$420.01-\$460; or
\$317	per day with local lodging expense \$100.01-\$140; or	\$773	per day with local lodging expense \$460.01-\$500; or
\$367	per day with local lodging expense \$140.01-\$180; or	\$824	per day with local lodging expense \$500.01-\$540; or
\$418	per day with local lodging expense \$180.01-\$220; or	\$874	per day with local lodging expense \$540.01-\$580; or
\$468	per day with local lodging expense \$220.01-\$260; or	\$925	per day with local lodging expense \$580.01-\$620; or
\$519	per day with local lodging expense \$260.01-\$300; or	\$976	per day with local lodging expense \$620.01-\$660; or
\$570	per day with local lodging expense \$301-\$340; or	\$1,026	per day with local lodging expense \$660.01-\$700.

Proof of lodging expense (copy of lodging invoice) will be provided with first invoice and anytime during assignment that such expense changes. Lodging expense is the sum of the room cost plus all applicable taxes.

TRAVEL From point of origin to jobsite and return travel. Travel expense includes (i) travel time at the applicable Class Rate A, B, or C, and
1. Airfare, taxis, limos, tolls and parking at actual cost plus personal auto transportation; or
2. Vehicles: Personal @ the allowed IRS mileage rate.

RENTAL In accordance with the Rates set forth in the ALSTOM "Schedule of Rates for In-Shop Services" and "Field Services And Equipment Rental Rates" in effect at the time Services are performed. All materials, transportation, shipping, special tools, fixtures, or non-ALSTOM support required to complete the Services shall be provided at ALSTOM's cost plus 25%.

The rates contained herein are effective January 1, 2011, and are subject to ALSTOM Power Inc. "Terms and Conditions for Service" in effect on the date the order is received. Rates are subject to change without notice.



2011 PREPA FIELD SERVICES AND EQUIPMENT RENTAL RATES

ALSTOM Caribe Inc., Turbine Division ("ALSTOM") rates do not include any Federal, State or local property, license, privilege, sales, service, use, excise, gross receipts or other like taxes which may now or hereafter be applicable to, measured by or imposed upon ALSTOM with respect to Services and equipment rentals. These rates are applicable for Services and Equipment Rentals provided to PREPA by ALSTOM directly or through ALSTOM Caribe Inc., Turbine Division, an ALSTOM Company.

ATTACHMENT 5

TECHNICAL FIELD ADVISORS, FIELD OPERATORS AND LABORERS - In accordance with the Rates set forth in the "Schedule of Rates for Field Advisors" in effect at the time Services are performed.

DIAGNOSTIC/ASSESSMENT TEST EQUIPMENT	Rental Price per Week ²	In/Out Cost ³
AC HiPot (100 KV)	\$5,784	\$649
AC HiPot (50 KV or 60 KV)	\$4,798	\$649
Coronascope	\$657	N/C
DC HiPot (50 KV)	\$3,484	N/C
DC HiPot (70 KV)	\$3,473	N/C
DIRIS Package 1	\$1,840	N/C
DIRIS Package 2 with rotor installed	Quoted per job	N/C
DIRIS Package 2 with rotor removed	\$3,155	N/C
DIRIS Package 2a Flow test	\$1,282	N/C
DIRIS Package 3 with rotor installed	Quoted per job	N/C
DIRIS Package 3 with rotor removed (Alstom Units Only)	\$4,798	N/C
DIRIS Package 4 AC Partial Discharge	\$6,113	\$649
DIRIS Package 4 DC High Voltage Tests	\$5,784	\$649
DIRIS Package 5	\$1,840	N/C
EL CID Low Flux Core Test	\$5,784	N/C
EL CID Remote Inspection Vehicle	\$3,969	N/C
Generator Diagnostic Inspection Kit	\$425	N/C
Infrared Camera	\$3,286	N/C
Megger (5 KV) BM 25	\$460	N/C
Megger DLRO 5KV	\$441	N/C
Megger Insulation Resistance Tester 5KV	\$441	N/C
Partial Discharge Capacitor (10 nF Tettex)	\$289	N/C
Partial Discharge/GOLD Measuring Equipment	\$1,877/Wk/\$626/Day	N/C
3.9mm Assessment Probe (Used With Assessment Borescope Only)	\$0/with Borescope	N/C
Spectrum Analyzer	\$4,741	N/C
Ultrasonic Flowmeter	\$681	N/C
Ultrasonic Sensor	\$421	N/C
UT Equipment for L-0 Steeples - Transducers/Probes/Calibration Block for DS48/DS 50/DS52 LP Designs	\$4,272	N/C
UT Equipment for L-0 Steeples - Transducers/Probes/Calibration Block for DS92/DS96 LP Designs	\$6,047	N/C
UT Equipment for L-0 Steeples - Transducers/Probes/Calibration Block for ND34 LP Designs	\$5,193	N/C
Vacuum pump	\$1,091	N/C
VARIAC (3-Phase)	\$131	N/C
VARIAC (single phase)	\$122	N/C
Videoprobe (Borescope) Visual Inspection Equipment (3.9 mm diameter) for Diagnostic Only	\$3,470	N/C
Videoprobe (Borescope) Visual Inspection Equipment (5, 6 or 8 mm diameter)	\$3,155	N/C
Videoprobe (Borescope) Visual Equipment w/additional monitor (6 & 8 mm diameter) for Assessment Only	\$4,457/Wk/\$689/Day	N/C
Videoprobe (Borescope) Visual Inspection Equipment (6 mm diameter) w/Optical Measurement Capability	\$3,681	N/C
Videoprobe (Borescope) Visual Inspection Equipment (6 or 8mm diameter) w/Digital VCR	\$3,418	N/C
Wedge Tightness Detector Test	\$1,874	N/C
WIDIPO II Inspection	\$4,470	N/C
WIDIPO III Inspection	\$5,784	N/C
COMMISSIONING/TEAMS EQUIPMENT AND INSTRUMENTATION	Rental Price per Week ²	In/Out Cost ³
Ashcroft Dead Weight Tester (APDTS-1)	\$375	N/C
AVR/SFC Set Option A (AVR Set Only AVR/SFC-01, AVR/SFC-02)	\$1,760	N/C
AVR/SFC Set Option B (AVR Set AVR/SFC-01, AVR-SFC-02 and Yokogawa Chart Recorder)	\$1,853	N/C
Bently Nevada Diagnostics Set (ADRE System) (BNDS-01, BNDS-02)	\$1,750	N/C
Commissioning Tool Box (CTS-01 or CTS-02)	\$1,899	N/C
DataPAC 1500 Data Collector/Analyzer	\$194	N/C
Digital Low Resistance Ohmmeter (MEG/DLRO-001)	\$229	N/C
Doble Relay Test Set - Option A (F6150 Unit Only)	\$2,712	N/C
Doble Relay Test Set Option B (F6150 and FS6300 High Power Unit)	\$2,712	N/C
EHC Test Set	\$751	N/C
Emission Test set, (Calibration Gas not included in rental price)	\$2,405	N/C
Fluke 196B / 199C Scopemeter	\$127	N/C
Fluke Data Acquisition System (2680A)	\$2,756	N/C
Fluke Hydra Data Logger W/Interface Box (2635A)	\$626	N/C
Function Generator	\$56	N/C
Gauge Set Option A (Gauge Set Only) (GS-01 or GS-03 Only)	\$1,160	N/C
Gauge Set Option B (Gauge Set GS-01, GS-03 and Manometer Set)	\$1,740	N/C
GE Druck Pressure Calibrator	\$187	N/C
GE Panametrics Transport Portable Liquid Flowmeter (PT878)	\$1,282	N/C
Graphlec Thermal Arraycorder (WR8500)	\$132	N/C

HART Field Communicator (375)	\$89	N/C
High Voltage Tool Set (HVTS-01)	\$137	N/C
Instrument and Controls Set (I&C-001)	\$1,850	N/C
Logger Kit 10KV (MEG-MIT-01)	\$229	N/C
Multi-Amp Relay Test Set (SSR-78)	\$394	N/C
Oscillographic Chart Recorder (4-channel) Yokogawa	\$438	N/C
Performance Test Set (BASE FLEET ONLY!!)	\$2,667	N/C
Portable Pneumatic Calibrator (PPC-01)	\$115	N/C
Pressure Calibrator 760 (PC-760)	\$115	N/C
Pressure Calibrator 800 (PC-800)	\$115	N/C
PRODAS Laptop Computer (GT24/26) (PRODAS-01, PRODAS-02)	\$311	N/C
Pulsation Probe Box 5 (includes Probe, Laptop, Measuring Amp, Cabling)	\$1,680	N/C
Pulsation Probe Box 1 (GT11D)	\$550	N/C
Pulsation Probe Box 2 (GT8 B/BC)	\$550	N/C
Pulsation Probe Box 3a (GT11NSBK)	\$550	N/C
Pulsation Probe Box 3b (GT11NSBK)	\$550	N/C
REG216 Laptop Computer	\$189	N/C
Shaker Table	\$644	N/C
Surface Roughness Tester	\$165	N/C
TEAMS Flowmeter	\$1,282	N/C
TEAMS Remote Position Monitor System	\$524	N/C
Tek-Know Pressure Calibrator (760)	\$131	N/C
Tek-Know Pressure Calibrator (800)	\$131	N/C
Valve Stroke Test Kit	\$116	N/C
Variac (3-Phase)	\$58	N/C
Vickers Test Kit Model (VKS-2000)	\$986	N/C
Wobulator	\$184	N/C
MEASUREMENT TOOLING		Rental Price per Week²
Digital Multimeter	\$18	N/C
Dynamometer	\$92	N/C
Faro Precision Integrated Level System	\$3,583	N/C
Gas Monitor	\$175	N/C
Laser Shaft Alignment System	\$2,431	N/C
Optical Level	\$184	N/C
Pressure Drop Measuring Kit (Westinghouse Stator)	\$417	N/C
Stauff Test Kit	\$184	N/C
Strain Gauge Shaft Alignment Equipment	\$1,972	N/C
Stud Micrometer	\$414	N/C
TOOLING		Rental Price per Week²
Double tip grinder extension (11N2)	\$263	N/C
Double tip grinder/boring bar basic unit (GT8,11N)	\$5,916	N/C
Grinding Toolbox (GT11N)	\$920	N/C
Blading Toolbox (GT8)	\$145/Day	N/C
Bolt Tensioner Hydratight - M110	\$1,155	N/C
Bolt Tensioner Hydratight - M125	\$1,155	N/C
Bolt Tensioner Hydratight - M140	\$998	N/C
Bolt Tensioner Hydratight - M160	\$998	N/C
Bolt Tensioner Hydratight - M90	\$893	N/C
Bolt Tensioner ITH - M110 Set of 2	\$1,213	N/C
Bolt Tensioner ITH - M125 Set of 2	\$1,213	N/C
Bolt Tensioner ITH - M160 (1pc)	\$1,047	N/C
Bolt Tensioner ITH - M90 Set of 2	\$937	N/C
Bolt Tensioner Set (ITH or Hydratight) M42, 48, 48 Compact, 56, 72, 80, 100	\$5,469	N/C
Chill Ring - Generator Types WX / WY 14/16/18" - Damper Rings	\$920	N/C
Concentricity Alignment Tool	\$460	N/C
Container - Empty 20'	\$1,736/Outage	\$1,000
Container - Empty 8'	\$868/Outage	N/C
Cuproplex Off Line System (cabinet, distribution rack, drum container (2, 30 gal drums) instrumentation,	\$1,048	N/C
Cuproplex On Line System (cabinet, drum container (3, 30 gal drums) instrumentation, consumables)	\$1,268	N/C
EHC Flush Kit	\$322	N/C
Eldec Single Induction Machine MFG 70	\$9,028	N/C
Faceplates for Retaining Ring Installation - Generator Types WX/WY 14/16/18	\$920	N/C
Gantry Crane - Aluminum/Adjustable Height (8' to 10' / 2 Ton Cap.)	\$301	N/C
Gantry Crane - Steel (10' / 1 Ton Cap.)	\$301	N/C
Gas Valve Repair Kit	\$0 with TFA	\$400
General Contractor Tool Set - Consisting of Five Containers 1-40', 1-20', 3-10'	\$33,000 /Outage	\$1,000
Generator Blocking Container - 8ft or 10ft	\$868/Outage	N/C
Generator Emergency Spare Parts & Special Tooling (One Cabinet)	\$2,084/Outage	N/C
Generator Rotor Stator Container	\$3,611	N/C
Generator Small Repair Tool Container (Set of 2 Cabinets for DE&NDE)	\$1,736	\$1,000
Generator Startup Container - 8'	\$868/Outage	N/C
Generator Stator Repair Tooling, Equipment, Consumables (Set of seven 20' Containers)	\$4,601	\$1,000
GT11 Rotor Turning Device	\$500	N/C
GT24 EIC/BBC Emergency Spare Parts (6 Units/A - G)	\$1,389	N/C

Horizontal Flange Repair Kit (Lapping Plates, Power Scrapers, Hand Scrapers, Grinders, Straight Edge)	\$1,315	N/C
Hydraulic Nut Splitter	\$608	N/C
Hydraulic Pipe Bender	\$92	N/C
Hydraulic TorcUp Set (3 pieces)	\$1,993	N/C
Hydraulic Tooling Set (3 Heads, Pump, Hoses)	\$1,380	N/C
Industrial Mechanical Bladders Tool Box	\$1,103	N/C
Industrial Mechanical Redbud Toolbox	\$1,103	N/C
Industrial Mechanical Rigging Tool Box	\$1,103	N/C
Industrial Mechanical Tool Boxes - Set of 3 cabinets	\$1,103	N/C
Industrial Mechanical Tool Container 20' (3 roll cabinets, ladders, aluminum ramp, rolling rack w/rigging)	\$2,100	\$1,000
Inlet Straightening Fixture w/ Alignment Gauge	\$868	N/C
Kelly Closure Systems (Set)	\$4,601	\$649
L-0 Hydraulic Blade Removal Tool	\$608	N/C
L-1 Mechanical Blade Spreader	\$122	N/C
M33 Coupling Bolt Tensioner Hydratight	\$526	N/C
M36 Coupling Bolt Tensioner Hydratight	\$526	N/C
M36 Coupling Bolt Tensioner ITH	\$526	N/C
M42 Coupling Bolt Tensioner	\$552	N/C
M42 Coupling Bolt Tensioner Hydratight	\$526	N/C
M45 Coupling Bolt Tensioner Hydratight	\$526	N/C
M48 Coupling Bolt Tensioner Hydratight	\$526	N/C
M52 Coupling Bolt Tensioner Hydratight	\$526	N/C
M56 Coupling Bolt Tensioner Hydratight	\$526	N/C
M64 Foundation Bolt Tensioners (2 per set) Hydratight	\$526	N/C
M80 Foundation Bolt Tensioners (2 per set) Hydratight	\$526	N/C
Micarta Rotor Power and Idler Roller Set (75Ton) w/Stand	\$2,426	N/C
Minac Induction Brazing System w/Chiller (Generator)	\$3,087	N/C
OOEM Containers (Set of four 20' containers)	\$33,750	\$1,000
Outage Site Infrastructure Materials (Set of 2 - 20' Containers)	\$14,470/Outage	\$1,000
Storage Bin Set With 24 Slots (8' X 4' X 7')	\$221/Outage	N/C
Phase Ring Support Base	\$243	N/C
Phase Separation Toolbox	\$92	N/C
Portable Sand Blaster	\$138	N/C
Portable Speed Heaters	\$2,917	N/C
Power Load Center (100 Amps)	\$986	N/C
Power Load Center (200 Amps)	\$1,380	N/C
Pressure Washer Brush Set (Tube Washer Set)	\$138	N/C
Richmond Measuring Toolbox	\$875	N/C
Rotor Blade Tip Grinder	\$2,315	N/C
Slip Ring Removal Tool Set	\$221	N/C
Stare Pump (Electric) for Bolt Tensioners (ITH or Hydratight)	\$1,117	N/C
Thread Mate Set - 1/2" to 1" (Coarse/Fine) and to 1" to 4" (Coarse) - 6 PT. (Norwoll)	\$506	N/C
Twistwire Roller Kit	\$460	N/C
Turbine Idler Roller with Support Stand (1 pair)	\$182	N/C
VAX Removal Tool Kit	\$2,500	N/C
Vertical Knee Milling Saw 9" x 42"	\$833	N/C
GT24 SPECIALTY TOOL/EQUIPMENT		
Assessment Tooling	Rental Price per Week ²	In/Out Cost ³
Bentley 3300 - Located in the Workshop	\$263/Outage	N/C
Baseblock for compound slide (GT24)	\$342	N/C
Blade tip grinder extension (GT24)	\$513	N/C
Blade tip grinder/boring bar basic unit (GT24)	\$263	N/C
Blading Toolbox (GT24)	\$5,916	N/C
Casing support CVC1/2 A (GT24)	\$1,262	N/C
Casing support CVC1/2 B (GT24)	\$1,985	N/C
Compound slide (GT24)	\$1,144	N/C
Extraction device LPT1 (GT24)	\$815	N/C
GT24 General Contractor tools - three 20' containers A & B & R (Rigging)	\$1,012	N/C
GT24 Tool Box - A/B Inspections	\$25,000/Outage	\$1,000
GT24 Tool Box - BOP Inspection	\$210	N/C
Helicoil Set (GT24)	\$237	N/C
Hydraulic bearings (GT24)	\$276	N/C
Hydraulic device complete (GT24)	\$1,091	N/C
Hydraulic rotor drive (GT24)	\$2,143	N/C
Jacking oil pump (GT24)	\$736	N/C
M90 Toolbox (GT24)	\$486	N/C
Measuring tool box D (GT24)	\$408	N/C
Spot Welder (GT24)	\$670	N/C
	\$138	N/C

WORKSHOP FIELD SUPPORT EQUIPMENT	Rental Price per Week ²	In/Out Cost ³
75 Ton Power Rollers	\$1,100	N/C
8' x 8' Oven with Purge	\$828	\$595
Additional Amplifiers IVS616	\$1,446	N/C
Balancing kit (Tools and Transducers) - Located In the Workshop	\$355	N/C
Bentley 3300 - Located in the Workshop	\$342	N/C
Bentley ADRE 16 Channel - Located in the Workshop	\$1,709	N/C
Bentley ADRE 8 Channel - Located in the Workshop	\$1,288	N/C
Beran 767 - Condition Monitoring Equipment	\$1,600	N/C
CADA System	\$3,497	NC
DP420 Star Structure Analysis	\$710	N/C
End Bell Removal Tool	\$810	N/C
Exciter Removal Toolbox-WX / WY 14/16/18	\$1,643	\$1,133
Field Machining Compound Slide	\$686	N/C
Field Machining General Toolbox	\$276/Outage	N/C
Field Machining Hydraulic Pump Units	\$1,050/Outage	N/C
Gas Turbine Rotor/Casing General Toolbox	\$290/Outage	N/C
General Generator Rotor Site Rewind Tools - 20' Container	\$8,681/Outage	N/C
Generator Collector Ring Machining Compound Slide	\$724	N/C
Generator Collector Ring Machining Toolbox	\$499	N/C
Generator Dovetail Slot Repair Machining Equipment	\$1,158	N/C
Generator Rotor General Toolbox	\$290/Outage	N/C
Generator Rotor Saddle kit (2 or 4 supports) (> 40 tons but not larger than 75 tons)	\$2,663	\$220
Generator Rotor Saddle kit (2 supports) (upto 40 tons)	\$1,852	\$220
Generator Rotor Site Rewind Tools - 20' Container	\$8,268/Outage	\$1,133
Generator Rotor skid (> 75 tons - or shipped via rail)	\$7,988	\$860
Generator Stator Phase Separation Repair Kit	\$290/Outage	N/C
GT 11 Turbine Rotor Skid	\$2,663	\$430
GT/ST Casing Boring Bar Equipment	\$6,178	\$556
HP/IP Turbine Rotor Skid	\$2,663	\$1,300
Induction Brazing Units-10/25/40KW	\$3,558	N/C
Induction Machine - 200KW	\$4,992	N/C
L-0 and L-1 Steeple Grinding Toolbox	\$869/Outage	N/C
Large End Bell Device	\$8,282	\$1,133
LP Turbine Rotor Skid	\$3,589	\$1,300
Particle and Fume Extractor System	\$955	N/C
Portable Closed Loop Water Chiller-Induction Applications	\$1,353	N/C
Portable Power Pack/Transformer, 200A Service	\$1,158/Outage	N/C
RSO Boxes	\$300	N/C
Schenk Balancing Machine for Rotors to 20 tons	Quoted per job	N/C
Sealing Kit (protective bag , rental of sealing iron only)	\$1,621	none
Sealing Kit (protective bag , rubber sheeting, dessicant, rental of sealing iron)	\$2,663	none
Snop Blocks/Risers	\$492	N/C
Small End Bell Device	\$4,154	\$1,133
Steam Turbine Rotor/Casing General Toolbox	\$289/Outage	N/C
Transducers - VSO 79	\$150	N/C
Transducers - VSO 80	\$75	N/C
Turbine Rotor Stands - site use only - not for transportation	\$1,874	N/C
TurboBalancer System	\$1,052	N/C
UMC (Lathe rate only)	\$5,784	\$4,532
VOM 50 (Portable Drill Press)	\$3,155	\$283
Welding & Stress Relief Power Source	\$1,158	N/C

SUPPORT SERVICES -In accordance with the Rates set forth in the "Schedule of Rates for In-Shop Services" in effect at the time Services are performed. Any materials, special tools, fixtures, or non-ALSTOM support required to complete the Services are at Alstom's cost plus 20%.

Notes:

- "Exclusions"** Rates do not include Operators who shall be invoiced in accordance with the applicable "Field Support" rate plus transportation and living expenses as set forth in "Schedule of Rate for Field Advisors" in effect at the time Services are performed.
- "Minimum Billing"** All Tools and Equipment are subject to a minimum rental charge of one (1) week. Rental period starts from day of dispatch from ALSTOM to day of return. Tools weekly rates are not prorated (i.e. nine (9) days equals two (2) weeks rental)
- "In/Out costs"** Are charges required to prepare equipment for shipment and exclude transportation costs and are charged on shipment to Customer and on receipt, at ALSTOM shipping point, from Customer.
- "Support Services"** Are charged as required for home office assistance to support unique or unusual problems or requirements necessary to allow proper operation of Tools and Equipment.
- "Tool and Equipment Transportation"** Invoiced at ALSTOM's cost plus a mark-up of 20% to cover overheads.
- "Unloading/Loading"** Customer shall provide un-loading off ALSTOM's carrier and loading onto carrier at Customer's site or designated service location at no charge or expense to ALSTOM.
- "Taxes"** Applicable (if) use tax on tool rental to be invoiced at cost plus 15%
- "Site Utilities/Support"** Customer shall furnish electricity, water, and other utility services, including connection of those services to ALSTOM Tools and Equipment and craft labor, as ALSTOM may require, to allow operation of the Tools and Equipment
- "Replacement / Restocking Cost"** - Rental Equipment & any contents of such equipment not returned complete will be replaced at the Customer expense. The charge to the Customer will be the replacement cost plus a 20% restocking fee. In no event shall any such charge for the missing item exceed the Alstom replacement cost.

rates contained herein are effective 1/1/2011 and are subject to ALSTOM, "General Terms and Conditions for Lease of Rental Equipment" in effect on the date the r is received. Rates are subject to change without notice.



ALSTOM Power Inc.
TURBINE GENERATOR DIVISION

General Terms and Conditions for Lease of Rental Equipment

1. GENERAL

The terms and conditions contained herein ("Terms"), together with any additional or different terms contained in ALSTOM Power Inc.'s, Turbine Generator Division ("ALSTOM") Proposal, if any, submitted to Customer (which Proposal shall have control over these Terms to the extent it contains any conflicting terms and conditions) constitute the entire agreement between the parties with respect to lease/rental of equipment and supersedes all prior communications and agreements. Acceptance by ALSTOM of Customer's order, or Customer's acceptance of ALSTOM's Proposal is expressly limited to and conditioned upon Customer's acceptance of these Terms which may not be changed or waived except in writing signed by the parties. Any additional, inconsistent, or different terms and conditions contained in Customer's purchase order or other documents supplied by Customer are hereby expressly rejected.

2. DELIVERY/RISK OF LOSS

- 2.1 Unless otherwise stated in ALSTOM's quotation, all Rental Equipment is delivered F.O.B. carrier at Customer's premises. Delivery dates are based on prompt receipt of all necessary information from Customer. ALSTOM reserves the right to deliver in installments.
- 2.2 Customer assumes all risk of loss or damage for Rental Equipment from the time of receipt on ALSTOM's carrier until such time as Rental Equipment is loaded on ALSTOM's carrier for return to ALSTOM. Off-loading and on-loading from and to ALSTOM's carrier at Customer's site shall be provided by Customer at its sole risk and expense.

3. PAYMENT

- 3.1 Payment for Rental Equipment will be invoiced monthly and payment is due 100% net thirty (30) days after date of ALSTOM's invoice for the Rental Equipment.
- 3.2 Rates for such Rental Equipment shall be as set forth in ALSTOM's Published Rates (if available/applicable) then in effect, unless ALSTOM has offered such Rental Equipment in a separate proposal accepted by Customer specifying different rates.
- 3.3 If payments are not made when due, Customer shall pay, in addition to the overdue payment, a late charge equal to the lesser of 1.5% per month or the highest applicable rate allowed by law on all such overdue amounts. No price adjustments shall be made for any advance payments.

4. CHANGES

Customer shall have the right to request, in writing, changes in delivery date or additions to or deletions from the general scope of Rental Equipment supply hereunder. ALSTOM will then prepare a notification reflecting all contract modifications resulting from such request, including, but not limited to, prices, delivery and schedule inclusive of any applicable minimum rental charges due. ALSTOM shall have no obligation to proceed with such request or Change Order until the parties have agreed in writing to the terms of such Change Order.

5. FORCE MAJEURE

ALSTOM shall not be liable for loss, damage, detention, or delay, nor be deemed to be in default from causes beyond its reasonable control or from fire, strike, labor difficulties, acts of terrorism, act or omission of any governmental authority or of Customer, compliance with governmental regulations, insurrection or riot, embargo, delays or shortages in transportation or inability to obtain necessary labor, materials, or manufacturing facilities from usual sources or from defects or delays in the performance of its suppliers or subcontractors due to any of the foregoing causes. In the event of delay due to any such cause, the date of delivery and the contract price will be adjusted as may be reasonably necessary to compensate ALSTOM for such delay.

6. WARRANTY

- 6.1 ALSTOM warrants that at the time of delivery to Customer the Rental Equipment supplied by ALSTOM will be in working order having been maintained by ALSTOM in accordance with the standards ordinarily employed by ALSTOM as an original equipment manufacturer.
- 6.2 Should the Rental Equipment, at the time of delivery, not conform to the standard set forth in 6.1, ALSTOM shall at its expense and option repair, replace or otherwise modify the Rental Equipment such that it conforms to the warranty set forth in 6.1. Customer shall not be charged for the periods during which Equipment is not serviceable due to ALSTOM's need to implement warranty cure provided that Customer's has immediately informed ALSTOM (within twenty-four (24) hours of discovery) of a need for cure.
- 6.3 THE FOREGOING WARRANTIES IN PARAGRAPH 6 ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES OF QUALITY AND PERFORMANCE AND RESULTS, WRITTEN, ORAL OR IMPLIED, AND ALL OTHER WARRANTIES INCLUDING ANY WARRANTY OR RESULTS OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED BY ALSTOM AND ALL EQUIPMENT MANUFACTURERS. CORRECTION OF NON-CONFORMITIES OR REFUNDS OF THE AMOUNTS PAID IN THE MANNER AND FOR THE PERIOD OF TIME PROVIDED ABOVE, SHALL BE THE CUSTOMER'S EXCLUSIVE REMEDY AND SHALL CONSTITUTE FULFILLMENT OF ALL LIABILITIES OF ALSTOM AND ALL PARTS MANUFACTURERS (INCLUDING ANY LIABILITY FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGE) WHETHER IN WARRANTY, CONTRACT, NEGLIGENCE, TORT, STRICT LIABILITY, OR OTHERWISE WITH RESPECT TO ANY NONCONFORMANCE OF OR DEFECT OR DEFICIENCY IN THE RENTAL EQUIPMENT SUPPLIED.

7. LIMITATION OF LIABILITY

- 7.1 ALSTOM's liability on any claim whether in contract, warranty, negligence, tort, strict liability, professional liability, or contribution shall in no case exceed the rental price allocable to the Rental Equipment which gives rise to the claim.
- 7.2 IN NO EVENT SHALL ALSTOM, ANY AFFILIATED COMPANY, ITS SUPPLIERS OR SUBCONTRACTORS BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL, OR CON-SEQUENTIAL DAMAGES, WHETHER IN CONTRACT, WARRANTY, TORT, NEGLIGENCE, STRICT LIABILITY PROFESSIONAL LIABILITY, CONTRIBUTION OR OTHERWISE, OR FOR LOSS OF PROFITS OR REVENUE, LOSS OF USE OF THE ORIGINAL EQUIPMENT, TECHNOLOGY OR ANY ASSOCIATED EQUIPMENT, COST OF CAPITAL, COST OF SUBSTITUTE EQUIPMENT, FACILITIES OR SERVICES, DOWNTIME COSTS, DELAYS, OR CLAIMS OF CUSTOMERS OF THE CUSTOMER OR OTHER THIRD PARTIES FOR SUCH OR OTHER DAMAGES.
- 7.3 All causes of action against ALSTOM arising out of or relating to this contract or the performance or breach hereof shall expire unless brought within one (1) year of the time of accrual thereof.

8. PATENT INDEMNITY

- 8.1 ALSTOM shall defend at its own expense any actions brought against Customer alleging that the Rental Equipment furnished hereunder by ALSTOM or the use of said Rental Equipment to practice any process supplied hereunder by ALSTOM directly infringes

any claim of a patent of the United States of America and to pay all damages and costs finally awarded in said actions. ALSTOM shall have the right to settle or otherwise terminate such actions in behalf of Customer.

- 8.2 ALSTOM shall have no obligations hereunder and this Paragraph 8 shall not apply (i) to any other equipment or processes, including Rental Equipment or processes supplied hereunder by ALSTOM which have been modified or combined with other equipment or processes; (ii) to any products or articles manufactured by any equipment or processes; (iii) to any patent issued after the date hereof; and (iv) in the event any of said actions are settled or otherwise terminated without the prior consent of ALSTOM.
- 8.3 If, in any action defended hereunder, the Rental Equipment are held to constitute infringement, or the practice of any process using the Rental Equipment is finally enjoined, ALSTOM shall at its option and its own expense, either procure for Customer the right to continue using said Rental Equipment; or, modify or replace it with noninfringing Rental Equipment; or, with Customer's assistance, modify the process so that it becomes noninfringing; or, remove it and refund the rental charges allocable to the infringing Rental Equipment.
- 8.4 To the extent that said Rental Equipment or any part thereof is modified by Customer, or combined by Customer with equipment or processes not furnished hereunder, except to the extent that ALSTOM is a contributory infringer, or said Rental Equipment or any part thereof is used by Customer to perform a process not furnished hereunder by ALSTOM or to produce an article, and by reason of said modification, combination, performance or production, an action is brought against ALSTOM, Customer agrees to defend and indemnify ALSTOM in the manner and to the extent Customer indemnifies Customer in this "Patent Indemnity" Paragraph.

THE FOREGOING PARAGRAPH 8 STATES THE ENTIRE LIABILITY OF ALSTOM AND EQUIPMENT MANUFACTURERS WITH RESPECT TO PATENT INFRINGEMENT.

9. TAXES

The rental price does not include any United States Federal, state or local property, license, privilege, sales, service, use, excise, value added, gross receipts, or other like taxes which may now or hereafter be applicable to, measured by, or imposed upon or with respect to this transaction, the Rental Equipment, its replacement, value or use, or any services performed in connection therewith. Customer agrees to pay or reimburse ALSTOM, its subcontractors or suppliers any such taxes which ALSTOM, its subcontractors or suppliers are required to pay or collect or which are required to be withheld. ALSTOM agrees to pay all such taxes which may be assessed by any governmental authority outside the United States.

10. LAWS AND REGULATIONS

ALSTOM does not assume any responsibility for compliance with federal, state, or local laws and regulations, except as expressly set forth herein, and compliance with any laws and regulations relating to the operation or use of the Rental Equipment is the sole responsibility of the Customer. All laws, regulations and design codes expressly incorporated herein shall be those in effect on the date hereof.

11. INSPECTION

- 11.1 Customer shall immediately upon receipt and prior to use inspect Rental Equipment upon receipt from ALSTOM, noting in writing to ALSTOM any defects, damages, missing or incorrect components or accessories, etc. etc. Rental equipment which contains defects, damages, missing or incorrect components or accessories, etc., shall not be used/operated until such time as ALSTOM or Customer (with ALSTOM's approval), has corrected the defect and/or provided replacement Rental Equipment. ALSTOM shall be provided reasonable access to Customer's facilities for the purposes of providing corrections needed as result of receipt inspections, inspecting the Rental Equipment to verify that Customer is properly operating and maintaining such Rental Equipment.
- 11.2 Customer shall return all Rental Equipment in an operable condition consistent with the condition such Rental Equipment was in when first operated by Customer, normal wear and tear excepted. On return receipt by ALSTOM, ALSTOM shall inspect such Rental Equipment to verify Customer's compliance with the foregoing obligation and, to the extent required, correct any and all defects and/or deficiencies at Customer's expense in accordance with the ALSTOM Published Rates then in effect. In no event shall any such corrective charge exceed the replacement cost of the Rental Equipment.
- 11.3 Customer shall indemnify and hold ALSTOM harmless from and against all claims, demands, liability, damages and expenses (including attorney's fees) arising out of personal injury (including death) or property damage to the extent arising out of the operation, use and/or possession of such Rental Equipment by Customer, its agents or employees.
- 11.4 Customer shall cause its insurers to name ALSTOM as an additional insured under its policies of insurance applicable to the site and Customer's equipment and to provide waivers of subrogation in favor of ALSTOM and its insurers.

12. ASSIGNMENT

Any assignment of these terms, any order or any of the rights and obligations hereunder without the prior written consent of ALSTOM shall be void.

13. CANCELLATION

Any order may be terminated by Customer only upon prior written notice and upon payment of all rental fees due and the cost of any repairs/corrections undertaken by ALSTOM in accordance with Article 11.2, INSPECTION.

14. PARTIAL INVALIDITY

If any provision herein or portion thereof shall for any reason be held invalid or unenforceable, such invalidity or unenforceability shall not affect any other provision or portion thereof, but these Conditions shall be construed as if such invalid or unenforceable provision or portion thereof had never been contained herein.

15. ALSTOM AND AFFILIATED COMPANIES

As used in these Terms the term (i) ALSTOM shall include its employees, officers, directors, subcontractors and vendors; and (ii) an "Affiliated Company" shall mean a company which directly or indirectly controls, or is controlled by or is under common control with ALSTOM, including without limit ALSTOM companies overseas, and includes their employees, officers, directors subcontractors and vendors. At its discretion, ALSTOM may utilize personnel who are employees of Affiliated Companies and may subcontract work to Affiliated Companies. Affiliated Companies shall not however be under legal obligation to Customer in connection with such Rental Equipment, and Customer agrees that it will look solely to ALSTOM as the responsible party in connection with all Rental Equipment to be furnished hereunder.

16. CHOICE OF LAW

The rights and remedies of the parties hereunder shall be governed by the law of the Commonwealth of Virginia.

END



CARIBE, INC.
Turbine Division
an ALSTOM Company

ATTACHMENT 6

**SCHEDULE OF RATES FOR MAINTENANCE TOOLS, MATERIALS,
AND SUBCONTRACTORS
PUERTO RICO ELECTRIC POWER AUTHORITY
(PREPA)
CALENDAR YEAR 2011**

The tools, materials and services are provided/performed by **ALSTOM** Caribe, Inc., Turbine Division., an ALSTOM Company, for equipment supplied by ALSTOM Power Inc., and its predecessors ABB ALSTOM Power Inc., ABB Power Generation Inc., and Brown Boveri Power Equipment Inc., and installed in Puerto Rico facilities. Tools and subcontractor services are offered to support installation, inspection, investigation, test, measurement, overhaul, and maintenance.

TOOLS RATE SCHEDULE ^{1, 2 &}

DESCRIPTION	Monthly	Weekly	Daily
Portable Machine Shop	\$5,895.60	\$1,457.58	N/A
Turbine Tool Box	\$10,537.62	\$3,512.88	N/A
Hydraulic Wrenches and Pump	\$7,652.04	\$2,697.90	\$852.72
Welding Machines	\$314.16	\$106.08	\$37.74
Welder 600 AMP	\$288.66	\$99.96	\$37.74
Welder 8 PAC	\$1,280.10	\$439.62	\$150.96
Pipe Threader	\$639.54	\$219.30	\$81.60
Magnetic Drill	\$250.92	\$87.72	\$32.64
6 Ton Chain Hoist	\$290.70	\$95.88	\$37.74
Portable Radio	\$326.40	\$107.10	\$39.78
Field Office	\$690.54	\$232.56	N/A
Computer	\$350.88	\$118.32	\$41.82
Fax Machine	\$144.84	\$49.98	\$17.34
Xerox Machine	\$276.42	\$93.84	\$35.70
Chemical Toilet	\$276.42	\$93.84	\$35.70

1. Third Party tool and equipment rentals such as forklift, mixer, scaffolding etc. will be billed at our cost plus (30%). Freight for all equipment and tools will be billed at cost plus (20%) percent for handling.
2. Subcontractors will be billed at cost plus (30%) for administrative fee. Subcontracted work will include: Blastcleaning, NDT, Machining, Insulation etc.
3. Applicable (if) use tax on tool rental to be invoiced at cost plus 15%.
4. Material purchased by ALSTOM at the customer's request will be billed at cost plus (30%) for administrative fee.

End





CARIBE, INC.
Turbine Division
an ALSTOM Company

ATTACHMENT 7

SCHEDULE OF RATES FOR JOBSITE CRAFT LABOR SERVICES
PUERTO RICO ELECTRIC POWER AUTHORITY
(PREPA)
CALENDAR YEAR 2011

The services are provided/performed by **ALSTOM** Caribe, Inc., Turbine Division., an ALSTOM Company, for equipment supplied by ALSTOM Power Inc., and its predecessors ABB ALSTOM Power Inc., ABB Power Generation Inc., and Brown Boveri Power Equipment Inc., and installed in Puerto Rican facilities. Jobsite Craft Labor Services are offered for support during installation, inspection, investigation, test, measurement, overhaul, and maintenance.

RATE SCHEDULE¹

DESCRIPTION	Straight Time ⁴ / Hour	Overtime ⁵ / Hour
Millwright Foreman	\$40.12	\$60.68
Millwright Journeyman	\$37.94	\$56.92
Pipefitter Foreman	\$42.92	\$64.88
Pipefitter Journeyman	\$40.56	\$60.84
Winder Helper	\$41.41	\$62.11
Electrician Foreman	\$52.17	\$78.26
Electrician Journeyman	\$39.61	\$59.41
General Laborer	\$35.07	\$52.60

1. Rates include applicable insurance, taxes and fringe benefits, small tools, consumables, and markups.
2. In addition to the hourly rate a daily per diem of \$38.10 per day, per craftsman will apply.
3. All Rates are subject to a MINIMUM BILLING requirement of "4 Hours" show-time or "8 Hours" if more than four (4) hours but less than eight (8) hours worked, if craft labor is mobilized to the site but cannot work Plus Per Diems as specified above.
4. "Straight Time" First "8 hours" worked Monday through Friday and ALSTOM and customers recognized holidays that differ from ALSTOM's when not worked.
5. "Overtime" Hours worked in excess of an "8 hour" workday, Monday through Friday, all day Saturday and Sunday and hours worked on observed Craft Holidays (New Years Day, Three Kings Day, Good Friday, US Independence Anniversary, Commonwealth Constitution Anniversary, Labor Day, Thanksgiving Day, and Christmas Day).
6. "Worked" Hours include all hours spent at Puerto Rican sites (including travel between sites or other locations, as necessary to perform work). Travel time between lodging and the Puerto Rico work location shall not be invoiced to customer.
7. "FONDO Insurance is not included, policy will be invoiced at cost plus 15%.

END



Attachment B

SOW	FACILITY NAME	PROJECT NAME	PROPOSED SCOPE OF WORK
1012 ⁵	San Juan Power Plant	Structural Repairs Fuel Service Tank 10	Structural steel repairs of floor, roof, shell, columns and beams elements of an existing fuel service tank and application of new anti-corrosive coating on the interior and exterior of the tank.
1013	San Juan Power Plant	Unit 5 SCR - Ammonium Procurement	Procurement and delivery of Ammonium Substance to be used for the Selective Catalytic Reduction system to control emissions of Unit 5 for compliance of federal law.
3049	Costa Sur Power Plant	Procurement of Water Heater 5 (Deaerator) Spare Pump	Procurement and delivery of a new spare pump for the water heater (deaerator) of unit 5.
3053	Costa Sur Power Plant	Procurement of Induced Draft Fan (IDF) and Forced Draft Fan (FDF) Spare Motors for Units 5 and 6	Procurement and delivery of motors to be storage as spare parts to avoid units forced outages and/or load limitations.
3054	Costa Sur Power Plant	Procurement of Condensate Pump (CP) Motor for Units 5 and 6	Procurement and delivery of motors to be storage as spare parts to avoid units forced outages and/or load limitations.
3057	Costa Sur Power Plant	Replacement of 4160 V Electric Cable Normal Transformer 5A, 5B	Procurement and delivery of 6000 ft. of special construction electrical cable (1500Kcmil Insulation XLPE 5kv) to replace the cables of the Normal service transformers 5A & 5B.
3066	Costa Sur Power Plant	AGC - Replacement Project	Procurement and delivery of new system for frequency/load control to replace the original one due to obsolescence (installed on 1973). There are no spare parts.
3067	Costa Sur Power Plant	Fuel Igniters Replacement Work	Procurement and delivery of new natural gas igniters and control system for Unit 6.
4076	Palo Seco Steam Plant	New Water Condensate 1-2 Tank	Removal of existing steel water condensate storage tank. Design and Build of a new 173,000 gal. steel water condensate storage tank, including interior

⁵ Deferred Project.

SOW	FACILITY NAME	PROJECT NAME	PROPOSED SCOPE OF WORK
			and exterior coating application, instrumentation system for reading water levels and improvements to the existing tank's concrete base.
4081	Palo Seco Steam Plant	Unit PS3 - Major Outage - Boiler Sections Replacement and Repairs; MPT, Generator and turbine Repair & Auxiliary Equipment Inspection Work	Purchase and installation of Economizer elements and waterwalls upper sections replacement. HP, IP and LP turbines inspection, maintenance, and repair. MPT oil leakages repair and Auxiliary equipment.
6088	Cambalache	Unit 1 Rehabilitation	Perform the required inspections, repair the exhaust gas housing and GT enclosure and filter house and replacement of all the hot gas path components, turbo-compressor and blades and its related accessories of Gas Turbine Num. 1. Also, conversion of control system to Blue-Line similar to gas turbines 2 and 3, upgrade the combustor pulsation monitoring system, upgrade the automatic voltage regulator and upgrade the opacity monitoring system.
6089 ⁶	Cambalache	Control System Power Plant Maintenance - Generator and Technical Services	Provide technical support and parts replacement for the generating unit control systems with Original Equipment Manufacturer trained technical advisors. The provided services will be a complete maintenance program for the continuous operations of the included equipment and its systems, especially for the obsolete equipment's. It will include parts replacement, software updates, backups, servers & network devices health issues solution and unexpected issues solutions.
6090	Cambalache	Automatic Voltage Regulator & SFC Upgrade for 2 Units	Upgrade of the obsolete electronic parts for the Automatic Voltage Regulator with the Synchronism Devices and the Static Frequency Converter systems for GT2 and

⁶ Deferred Project.

SOW	FACILITY NAME	PROJECT NAME	PROPOSED SCOPE OF WORK
			GT3. The actual systems are the original ones installed in 1997
6091	Cambalache	LTSA for Units 1, 2, 3 Inspections,	Long Term Service Agreement for the A, B & C (Major) inspections on the Cambalache Units. Provide the technical advisors and consumables for all the inspections and the replacement of the scheduled Hot Gas Path parts (capital parts) The A & B are the minor inspections.