هيئة كفاءة الإنفاق والمشروعات الحكومية
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Project Construction Mechanical Works Procedure

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1.0 PURPOSE

This procedure identifies the minimum controls, timing of exchange, and responsible parties necessary to ensure the quality and documentation requirements for the Work Operations associated with Mechanical Construction Works.

This procedure applies to works performed under all Government construction projects executed throughout the Kingdom of Saudi Arabia.

For the purposes of the Construction Management Procedures the Project Management Company is the Entity Project Management Organization (EPMO) appointed by the Entity and references prefixed with “Site”, such as Site Construction Department, Site Engineering Department, represent the Project Management Company at Project level, on construction sites.

2.0 SCOPE

This procedure is not applicable to heavy industrial rotating equipment such as gas or steam turbines, boilers, conveyors or material handling equipment, etc.

This procedure does not address the hot alignment of rotating mechanical equipment.

This procedure applies to permanent equipment and is not applicable to the installation of temporary rotating equipment or components used as part of the construction process.

Construction Contractor shall develop procedures to receive, install and test Mechanical Equipment, the procedures to cover as a minimum the following:

1. Static Equipment
2. Rotating Equipment
3. System and Equipment Lock Out/Tag Out

3.0 DEFINITIONS

Definitions	Description
Architect/Engineer (A/E) Consultant	Architectural/Engineer Consultant appointed by the EPMO to undertake the design of the project.
Entity Project Management Organization (EPMO)	An Entity Project Management Organization, this is an integrated team that comprises the Entity and its PMC responsible for managing all the Entity’s projects.
Change Request	A 2nd Party-initiated request for an Entity Change Notice due to some differing site conditions, constructive change, or similar event justifying issuance of a Change Notice. A contractual notice advising the Contractor of a potential compensable change.
Design Change Notice (DCN)	A notification to the design team when design documents need to be revised or updated.
Field Change Document (FCD)	A document used to make a change to an issued design document at site. Once approved, it is a valid design document.
Non-Conforming Items (Non-Conformance Report, NCR)	A deficiency in characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate.
Technical Query (TQ)	A document used to request formal clarification of contract documents, design documents, or design intentions. A TQ may not be used to change design, schedule, or cost.
Static Equipment	As used in this procedure, the term “Static Equipment” is a general term that includes all material, devices, appliances,

Definitions	Description
	fixtures and apparatus used as part of a stationary equipment installation, i.e. non-rotating
Site Contracts Department	Department within the Project Management Company that is responsible for administering Contracts
Site Construction Department	Department within the Project Management Company that is responsible for Construction activities / operations
Site Engineering Department	Department within the Project Management Company that is responsible for Engineering or design activities / operations
Enterprise Content Management System (ECMS)	An information management and collaboration platform for managing and controlling project documents and records.

4.0 REFERENCES

1. EPM-KCQ-PR-000005 - Project Construction Quality Management System Procedure
2. EPM-KCE-PR-000007 - Project Construction As-Built Drawings Procedure
3. EPM-KCC-PR-000002 - Project Construction Field Work Activities Procedure
4. EPM-KCC-PR-000003 - Project Construction Completions and Turnover Procedure
5. EPM-KCE-PR-000003 - Project Construction Field Change Documents Procedure
6. EPM-KCE-PR-000009 - Project Construction Civil Works Procedure
7. EPM-KCE-PR-000010 - Project Construction Piping Works Procedure

5.0 RESPONSIBILITIES

5.1 Construction Contractor

The Construction Contractor is responsible for planning and executing the Mechanical Works in accordance with the contract requirements and specifications

Site Construction Department
The Site Construction Department shall be responsible for coordinating all site-based construction support and lead the management of the Construction Contractor.

6.0 PROCESS

6.1 General

The Construction Contractor shall plan and execute the works in accordance with EPM-KCE-PR-000002, Project Construction Field Work Activities Procedure.

6.2 Mechanical Equipment Install

The Construction Contractor shall prepare a Construction Mechanical Work Plan which will describe the methods of installation for the Construction Mechanical Works and will also provide a tracking tool for the identification of components and installation progress of the Mechanical work.

The Construction Contractor shall procure, if required, the necessary mechanical equipment to meet the project requirements. In general, the vendor will prepare equipment specific equipment drawings for submission and review by the Site Construction Department with final approval (via the Site Engineering Department) by the Engineering Department / A/E Consultant / Design Firm.

The Construction Contractor shall establish a Safety Lock-out / Tag-out Procedure to control the connection of electrical circuits to hazardous energy and/or connections of piping to other hazardous conditions.

Installed and energized equipment shall be locked out of operation unless under specifically approved and managed permit.

The Construction Contractor shall undertake the installation of mechanical equipment in accordance with the contract requirements, specifications, drawings and approved vendor drawings and installation manuals and final approval (via the Site Engineering Department) by the Engineering Department / A/E Consultant / Design Firm.

Inspection of mechanical equipment installation activities shall be in accordance with the contract requirements, however shall at a minimum cover the items identified in Attachment 3 - Project Construction Inspection and Test Plan Template (Sample).

The Construction Contractor shall procure spare parts, provide relevant training and deliver Operation and Maintenance Manuals to the Entity (EPMO) at Completion of the Works and Turnover as required under Project Construction Completions and Turnover Procedure - EPM-KCC-PR-000003, all in accordance with and as required by, the Contract.

All changes, including those directed by an equipment vendor's representative(s), are to be documented on a Field Change Document (FCD) in accordance with EPM-KCE-PR-000003 Project Construction Field Change Documents Procedure and final approval will be provided (via the Site Engineering Department) by the Engineering Department / A/E Consultant / Design Firm.

The Construction Contractor shall ensure that all work that is designed to be undertaken in a confined space, is performed in accordance with the Construction Contractor's Safety Department's procedures.

Reference should also be made to the Expro Projects White Book Volume 11 HSSE where further information regarding working in confined spaces, lockout / tagout etc. will be found.

6.3 Static Equipment

6.3.1 Material Receiving and Control

1. Verify that nameplate data is correct
2. No physical damage is visible
3. Ensure all equipment is maintained as per Vendor and project documents.
4. Ensure the nitrogen purge is maintained (when required).

6.3.2 Pre-Installation

1. Ensure that the proper template is used for anchor bolt setting and that the template is properly oriented.
2. Ensure that the Anchor Bolt locations are correct and bolts are plum with proper projection/thread length and acceptable physical condition.
3. Ensure foundation is properly prepared and grouted (if applicable).
4. Concrete foundation has met minimum comprehensive strength requirements.
5. Ensure Structural Steel supports are designed, inspected, and properly documented including painted and coated.
6. Ensure Shims are smooth, flat, and free of dirt or foreign materials.
7. Ensure Bed plate (fixed and sliding ends) are painted and/or coated.
8. Ensure Slide plate is lubricated, and Teflon or similar surface is complete.

6.3.3 Pre-Erection Peripheral Component Installation

Ensure peripheral components are installed (where possible) prior to erecting the static equipment. Peripheral components typically include:

1. Ladders and platforms
2. Piping spools and any down comers
3. Instruments and instrumentation commodities
4. Electrical commodities
5. Vessel internals (lining, trays, etc.)
6. Insulation

Construction Contractor shall ensure that the following activities are carried out, verified, in accordance with vendor and project requirements (such as Specifications, Issued for Construction (IFC) drawings, vendor documents etc. and recorded. See the Project Construction Static Equipment Checklist Template (Sample) as shown in Attachment 1.

1. Ensure slide plates or bed plates are installed and leveled
2. Ensure the equipment is positioned on the foundation or slide/bed plate and the nozzle orientations and elevations are correct
3. Ensure electrical grounding is installed
4. Ensure that piping is properly aligned and pipe supports are installed correctly
5. Ensure that the static equipment is grouted
6. Ensure entry permits for designated confined spaces are in-place (where applicable) before entering equipment.
7. Ensure that equipment internals are installed.
8. Ensure that field pressure testing of stationary equipment is conducted (when required)
9. Ensure that equipment coatings are completed
10. Ensure that equipment insulation is installed (if required)
11. Ensure that all stationary equipment is kept clean throughout the installation process.
12. Ensure that cleanliness inspections are performed prior to final closure.

6.4 Rotating Equipment

Construction Contractor shall ensure that the following activities are carried out, verified and recorded in accordance with vendor and project requirements (such as Specifications, IFC drawings, vendor documents, etc.)

6.4.1 Pre-Installation

1. Anchor bolts locations are checked for proper layout, plumbness, projection/thread length and acceptable physical condition. Anchor bolts and nuts are free of oxidation and dirt, and are clean and lubricated as required. Precheck prior to applicable concrete placement as well as post check concrete placement.
2. If equipment is being placed on a concrete foundation and requires grouting, the foundation is properly prepared and inspected in accordance with applicable design drawings and specifications prior to setting equipment on the foundation.
3. If equipment is being placed on structural steel, the steel is painted and/or coated in accordance with applicable design drawings and specifications. This includes welded attachments/anchor studs, etc.
4. Coating on the bottom of the equipment or equipment skid is checked for compliance with design requirements.
5. Shims are smooth, flat and free of dirt or foreign materials.
6. Bed plates (fixed and sliding ends) are painted and/or coated in accordance with project specifications. Inspection of slide plate lubrication, Teflon or similar surface is complete.
7. Crane area(s) are prepared and nearby installations (foundations and underground commodities) are protected.

6.4.2 Installation Activities

6.4.2.1 Soleplate Installation and Levelling

1. Ensure soleplate(s) are installed and level.
2. Verify that soleplate load bearing surfaces are flat before being set
3. For equipment installations where the equipment is bolted to the soleplate(s) prior to grouting, ensure an alignment check is performed to verify that coupling spacing and final alignment can be achieved without modification to the equipment feet or hold down bolts.
4. In accordance with EPM-KCE-PR-000009, Project Construction Civil Works Procedure, ensure that soleplate(s) are grouted after the location and levelness has been checked.

6.4.2.2 Setting and Levelling Equipment

1. Ensure that the equipment is positioned on the soleplate or foundation, it is level, and in its final location.
2. Verify that equipment is in the correct position and is level

6.4.2.3 Rough Alignment of Equipment

1. If required and prior to grouting equipment, ensure a “rough” alignment check (rim and face) is performed to verify that coupling spacing and final alignment can be achieved without modifying the hold down bolts or the machine feet.

6.4.2.4 Grouting of Equipment Baseplates

1. Prior to grouting, verify the existence and adequacy of grout pour and vent holes.
2. At the completion of rough alignment and verification of adequate grout pour and vent holes, ensure equipment base plates are grouted in accordance with vendor / supplier requirements and EPM-KCE-PR-000009, Project Civil Works Procedure.

6.4.2.5 Preliminary Alignment

1. When shafts are rotated during alignment, always rotate shafts in the same direction and as indicated for the driven piece of equipment.
2. Ensure that post grout equipment restoration has been performed and that anchor bolts have been tightened/torqued before beginning preliminary alignment activities.
3. Verify that bolts are tightened/torqued
4. Ensure the equipment is aligned and soft-foot is eliminated.
5. After soft-foot has been eliminated, confirm alignment parameters

6.4.2.6 Piping Alignment

1. Ensure that the piping is aligned and pipe supports are installed.
2. Welding of the piping (spool) connected (flange connection) directly to the equipment shall be performed after the alignment of the equipment has been made to assure that the appropriate alignment of the piping with the equipment has been made.

6.4.2.7 Field Pressure Testing of Rotating Equipment

1. Ensure field pressure testing of rotating equipment is conducted in accordance with the manufacturer’s instructions and EPM-KCE-PR-000010 Project construction Piping Works.

6.4.2.8 Cleanliness and Final Closure

1. Ensure that rotating equipment is kept clean throughout the installation process.

6.4.2.9 Equipment Assembly

1. Ensure rotating equipment assembly is completed.

2. A Service Representative for the equipment vendor is recommended to comply with his contract's requirements; however, as a minimum, the Representative is to support and witness the assembly and/or perform final acceptance of the equipment installation, if required.

6.4.2.10 Final Alignment

1. Ensure that piping alignment and pressure testing of pipe are completed before starting final alignment activities.
2. Ensure the equipment is aligned.
3. Verify if equipment adjustment or re-shimming is required during the final alignment

6.4.2.11 Coupling Assembly and Bolt-Up

1. Ensure uncoupled testing is complete before final coupling assembly and bolt-up.
2. Ensure coupling is assembled and bolted up and the coupling guard is installed.

6.4.2.12 Chain or Belt Driven Equipment

1. Ensure that chain or belt-driven equipment is installed.

Note**:** For chain or belt driven equipment, only a final alignment operation is required.

6.4.2.13 Insulation and Coatings

1. Ensure equipment insulation is installed in accordance with EPM-KCE-PR-000009 Project Construction Civil Works Procedure and vendor recommendations.
2. Ensure that coatings are applied in accordance with EPM-KCE-PR-000009, Project Construction Civil Works Procedure.

6.4.2.14 Final Inspection and Acceptance

1. Ensure that all required equipment vendor representative witness points and inspections are complete.
2. Verify that all pre-installation and installation activities are accepted and documented on applicable documents as shown, Project Construction Rotating Equipment Checklist Template (Sample) Attachment 2.

7.0 ATTACHMENTS

1. EPM-KCE-TP-000001 - Project Construction Static Equipment Checklist
2. EPM-KCE-TP-000002 - Project Construction Rotating Equipment Checklist
3. EPM-KCE-TP-000003 - Project Construction Inspection and Test Plan for Mechanical Equipment Activities Template

Attachment 1 - EPM-KCE-TP-000001 - Project Construction Static Equipment Checklist

Report No.			Date:
Project Name:			Project No.
System No.		Equipment Identification:	Area:

REFERENCE DOCUMENT No.	Rev. No.	REMARKS

ITEM	ACCEPT	DATE	REMARKS
1. Nameplate data is correct			
2. Storage and Maintenance Measures Implemented			
3. Pre-Installation Checks			
a. Anchor bolt locations are correct and bolts are plum with proper projection/thread length and acceptable physical condition.			
b. Foundation is properly prepared and grouted (if applicable).			
c. Concrete foundation has met minimum comprehensive strength requirements.			
d. Structural Steel supports are designed, inspected, and properly documented including painted and coated.			
e. Shims are smooth, flat, and free of dirt or foreign materials.			
f. Red plate (fixed and sliding ends) are painted and/or coated.			
g. Slide plate is lubricated, and Teflon® or similar surface is complete.			
4. Unit is Shimmed and Set			
5. Slide/Bed Plates Installed and Level			
6. Centerline location is correct			
7. Orientation and Elevations are correct			
8. Plumbness is acceptable			
9. Grouting is complete			
10. Anchor bolts have been tightened or torqued			
11. Piping alignment is acceptable			
12. Installation of internals is complete			
13. Field Testing is complete			
14. Field flushing or cleaning is complete			
15. Internal cleanliness is acceptable			
16. Ladders and platforms are complete			
17. Closures and Manways are complete			
18. Grounding is complete			
19. Instruments and controls are complete			
20. External painting/coatings are complete			
21. Insulation is complete			

COMMENTS:

RESPONSIBLE ENGINEER:

(Name / Signature) (Date)

Attachment 2 - EPM-KCE-TP-000002 - Project Construction Rotating Equipment Checklist

Report No.			Date:
Project Name:			Project No.
System No.		Equipment Identification:	Area:
REFERENCE DOCUMENT No.	Rev. No.	REMARKS	

ITEM	ACCEPT	N/A	REMARKS
1. Nameplate data is correct			
2. Foundation complete and anchor bolts set			
3. Pre-Installation Checks			
a. Anchor bolt locations are correct and bolts are plum with proper projection/thread length and acceptable physical condition.			
b. Foundation is properly prepared and grouted (if applicable).			
c. Concrete foundation has met minimum comprehensive strength requirements.			
d. Structural Steel supports are designed, inspected, and properly documented including painted and coated.			
e. Shims are smooth, flat, and free of dirt or foreign materials.			
f. Red plate (fixed and sliding ends) are painted and/or coated.			
g. Slide plate is lubricated, and Teflon® or similar surface is complete.			
h. Load bearing/leveling surfaces of plates, blocks, rails, sole plates are flat within tolerances			
4. Unit set on foundation			
5. Levelness of base plates, blocks, rails, sole plates, etc., and/or the equipment are within tolerances			
6. Centerline location and elevation checked			
7. Anchor bolts torqued			
8. Preliminary alignment and soft foot check complete			
9. Grouting complete			
10. Auxiliary systems (i.e. lube/seal oil, balance, cooling, hydraulic, etc.) are properly cleaned, flushed and connected			
11. Preservative compounds greases, and oils cleaned from equipment. Desiccant is removed			
12. Inspect, clean and install, or reinstall mechanical seals, packing, wipers, etc.			
13. Final alignment is complete			
14. Systems charged with specified operating fluid			
15. Provide and install temporary compressor suction strainers.			
16. Rotation of driven and driving equipment Is correct.			
17. Coupling Assembled			
18. Sheaves and belts alignment and tensioned.			
19. Instruments and controls checked			
20. Insulation complete			
COMMENTS:			
RESPONSIBLE ENGINEER:			

(Name / Signature) (Date)

Attachment 3 - EPM-KCE-TP-000003 - Project Construction Inspection and Test Plan for Mechanical Equipment Install Activities Template

Activity No.	Activity Description	Inspection/Test Requirements		Reference Documentation		Method of Verification (see Legend)		Demonstrated Evidence Report / Checklist Reference No.
		Test or Inspection Performed	Stage/Frequency	Code/ Spec/ Etc.	Acceptance Criteria	Construction Contractor. QC	Customer/Rep.	
1.0	**Document review**							
1.1		Confirm documents: • Design drawing • Method statement • Material submittal	Prior to commencement	Project Specific	Project Specific			
2.0	**Material receiving inspection**							
2.1		Visual inspection for damage, deformity and correct label	Project Specific	Project Specific	Project Specific			
3.0	**Storage**							
3.1		Refer to method statement & manufacturer's recommendation	Project Specific	Project Specific	Project Specific			
4.0	**Preparation for Installation – Visual Inspection**							
4.1		Equipment area ready - including foundation, anchor bolts, piping connection, electric power connection	Project Specific	Project Specific	Project Specific			
5.0	**Installation**							
5.1		Check orientation of suction and discharge nozzles in respect to pump rotation	Project Specific	Project Specific	Project Specific			
5.2		Check the orientation of fixing dowbolts	Project Specific	Project Specific	Project Specific			
6.0	**Installation of connecting piping**							
6.1		Visual inspection to verify equipment alignment and level as per layout drawing	Project Specific	Project Specific	Project Specific			
6.2		Check torqueing is as per the spec	Project Specific	Project Specific	Project Specific			
6.3		Check for leaks and pressure drops	Project Specific	Project Specific	Project Specific			
7.0	**Installation of Equipment Controller & Electrical Connections**							
7.1		Visual Inspection & Testing	Project Specific	Project Specific	Project Specific			