

Engineering Procedure

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Fiber Reinforced Plastic Grating Installation Guide

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1 Scope

This installation guideline provides recommendations for the fabrication and installation of fiber reinforced plastic (FRP) grating systems on offshore platforms. The objective is to provide guidelines for achieving durable, cost effective installations of FRP grating systems that meet the specified performance requirements. This document is intended for the use of the project engineers, maintenance, and the fabrication/installation contractors.

The recommendations apply to delivery inspection, handling, storage, fabrication, installation, health and safety.

2 Conflicts and Deviations

Conflicts between this Engineering Procedure and any other Mandatory Saudi Aramco Engineering Requirements (MSAERs) shall be resolved by the Consulting Services Department in writing.

3 Applicable Document

Saudi Aramco Engineering Standard

[SAES-M-005](#) *Design and Construction of Fixed Offshore Platforms*

4 General Requirement

The CONTRACTOR shall furnish, fabricate (where necessary), and install all fiberglass reinforced plastic (FRP) grating, with all accessories and incidentals necessary to produce a complete and serviceable installation as specified by the contract documents.

FRP grating installations should be engineered in advance as per [SAES-M-005](#). The scope of work documents for engineered systems may include drawings for each grating panel that permit shop fabrication of grating sections before delivery. However, FRP grating is readily cut and fit at the job site. This eliminates the cost of engineering and allows the delivery of grating with standard panel dimensions.

5 Delivery Inspection

The quantity, dimensions and special requirements of all grating components shall be verified for compliance with the purchase order and the shipping documents. Shipments not complying with the purchase order or the shipping documents shall be reported to vendor for corrective action.

All grating components should be visually inspected for damage that may have occurred during shipment. Grating components or materials that are rejected should be reported to vendor for corrective action.

Resin sealant kits shall be inspected to ensure that the kits have remaining shelf life, contain all the necessary materials and that containers are not damaged or leaking.

6 Handling and Storage

All grating materials shall be handled with care to prevent cracking, chipping and other types of damage. Materials should be stored in an area free of construction debris. Store adhesives, resins, their catalysts and hardeners in dry storage facilities between 50°F (10°C) and 85°F (30°C), until they are needed for fabrication work.

7 Grating Fabrication

7.1 Layout

Pultruded grating shall always be installed with the bearing bars spanning the supporting structure. Standard panel sizes include 3, 4 or 5 ft widths and 8, 10, 12 ft lengths, having a manufacturing tolerance of ± 0.25 inch (6.4 mm), for both width and length. Custom panels within the 5 x 20 ft envelope are available by special order. The panels are marked to fit the supporting structure, including cutouts to accommodate piping that runs vertically through the deck.

7.2 On Site Fabrication – Safety Precautions

Installation personnel should review all the Material Safety Data Sheets provided by the manufacturer before beginning installation operations. Adequate ventilation and all necessary safety precaution, shall be followed when cutting or drilling fiberglass products or when sealing or adhesive bonding with resin products.

7.3 Cutting

FRP grating should be cut on the job site with ordinary carpenter's tools. Cuts should be made with abrasive (preferably carbide or diamond) tipped tools that leave machined surfaces free of delaminations, splinters, dry fiber and crazes in the resin. Cross cuts and rip cuts should be made using a circular saw with 30 to 40 grit cutting blades. Diamond grit blades are best for fast cuts and long blade life.

Most reciprocating saws (e.g., Sawzall, jig saw, etc.) are suitable for cutting holes and notches, however, cordless saws are preferred. Blades should be abrasive tipped and tungsten carbide tipped blades are recommended. Routers

with tools and speeds suitable for fiberglass are also recommended for cutting grating where appropriate.

7.4 Sealing Cuts

All shop fabricated cuts should be coated with polyester, vinyl ester or epoxy resins in accordance with manufacturer's specifications. All field fabricated cuts should also be coated by the contractor in accordance with the manufacturer's instructions. The usual coating requirement is a thermoset resin applied by paint roller. Some manufacturers allow clear urethane or acrylic spray coatings as an alternative to thermoset resin coatings.

7.5 Framing and Finishing of Cutouts

Where it is desired to close openings between the grating and penetrating objects (e.g., pipes, tubes, ducts, etc.) to reduce the chance of small objects falling through the opening, the cutouts can be framed with rings or collars using fiberglass plate or "F" sections (a panel connector). Fiberglass plate and "F" section panels are readily available in polyester resin from grating manufacturers.

7.6 Inspection of Fabricated Parts

Inspection of fabrication operations is permitted as requested by the owner, Saudi Aramco. The fabricator shall give ample notice to contractor prior to the beginning of any fabrication work so that inspection may be provided. Fabricated gratings should be subjected to the visual defect requirements described in Section 5.

8 Installation

The contractor shall prepare assembly drawings that should be followed during grating installation. Grating panels shall be secured with hold-down fasteners as specified herein.

Contractor to ensure that when installing FRP grating to offshore platform boat landings, that the panels are installed, running in a North to South direction to minimize exposed cut panels to wave and swell loading.

8.1 Training of Installation Personnel

The manufacturer shall provide training of contractor's installation personnel as requested on the purchase order as per international industrial standard.

8.2 Inspection of Installation

The manufacturer shall provide spot inspection of the installation as requested on the purchase order.

8.3 Structural Support of Cutouts

FRP grating may lose stiffness and strength as a result of cutouts. The entire cutout section should be reinforced if not fully supported by end support. Special attention is required to ensure adequate support of FRP grating at cutout locations. Generally, cutouts should be reinforced if deflections at the cutout perimeter exceed 0.25 inch (6.4 mm) under a concentrated load of 250 lb (113 kg). Sometimes cutouts can be supported from the backside by adding steel support angle to the penetrating structure, if permissible, or by adding additional steel cross members to support the cut ends of the bearing bars.

Cutouts can also be reinforced by bonding 0.375 inch (9.5 mm) or 0.25 inch (6.4 mm) fiberglass plate to the grating over the cutout. The plate can be fitted to piping that protrudes through the cutout. This technique is recommended when there are multiple penetrations in close proximity.

End support shall be provided where the grating is cut around objects and at the edges as specified by [SAES-M-005](#), section 8.6.1b. Appropriate structural supports should be designed and fabricated to provide a permanent support to the cut panel. Supporting gratings by penetrating non-structural objects is prohibited unless detailed analysis shows that induced stresses and deflection on the supporting object are within allowable limits.

Fiberglass F section kick plate provides good reinforcement for square or rectangular cutouts. The "F" profile is forced into position over the edge of the cut grating with a rubber mallet. "F" section kick plate can be bonded in place if desired.

8.4 Fastening Hardware

All fastening hardware shall be made of stainless steel type 316 and be provided by the contractor. These clips shall be used at a minimum, one at each panel corner and two on each crossing over support beams. This configuration should result in one hold-down clip per 4 square feet of grating surface. Appropriate clips, such as F clips, shall be provided to tie adjacent grating panels at the splice whenever the net span exceeds 36 inches (914 mm).

Additional fasteners, Type GC, made of 316 stainless steel, should be installed at boatlanding locations and cellar decks, resulting in two (2) hold-down clips per four (4) square feet of grating.

Grating fasteners may be attached to the supporting structure by one of the following methods:

- 8.4.1 Grating should be attached to the supporting steel with G clips or Hilti clips. G clips should be used with top mounted clamps over the grating connected to friction clips (G clips) placed under the supporting steel. The clamp is connected to the clip by a 0.25 inch (6.4 mm) - 20 bolts. The studs for G clips shall be the type that is not separable from the clips to ensure that the clips can not be dropped through the grating during maintenance work. G clips should not be used to attach stair treads.

Gratings at offshore platform cellar-decks and boat landing areas should be fastened using Type GC fasteners with a 2 diameter hold down top plate.

Hilti clips are connected by threaded bolts that screw into threaded anchor studs that are shot into the supporting steel. The primary advantage is rapid installation and lower installation labor costs.

- 8.4.2 The fasteners for wave zone gratings should be heavy duty saddle clips attached with heavy duty bolts, nuts and lock washers. Saddle clips may be attached by bolt and nut through drilled holes, by self tapping screws through drilled holes or by shot studs in the supporting steel. Wave zone gratings shall be attached to brackets that are designed for the specified wave loads.

All grating fasteners shall be equipped with lock washers or nuts with nylon inserts or an equivalent locking design approved by the Owner to ensure that fasteners remain tight during the service life of the platform.

9 Health and Safety

In general, all safety precautions set forth by the grating manufacturer should be adopted. Materials Safety Data Sheets (MSDS) should always be read by the contractor personnel before commencing work and should be implemented as per given checklist by manufacturer.

9.1 Work Site Safety Measures

Fiberglass grating may slide underfoot when positioned on the supporting structure before it is secured by fasteners. Grating installation work sites should be barricaded and clearly designated at all times to prevent general construction personnel and pedestrians from stepping on grating panels before all fasteners have been installed and inspected. The same precaution should be exercised when grating panels are removed for construction or maintenance operations.

Precaution should be exercised to prevent the potential of falls through the deck because of non-secured grating panels.

9.2 Installer Safety Training

Grating installation personnel must take all "health and safety" training before installation work is started on each offshore facilities project.

9.3 Safety Equipment for Installers

The contractor installation personnel shall acquire all the necessary health and safety accessories including safety glasses, ear protection, hard hats, steel toe shoes and a fall protection safety harness. Installation personnel must also use face shields and dust masks during cutting and sanding operations. Leather gloves are recommended to prevent fiber splinters and pinch injuries to the hands of installers. Latex gloves are recommended when handling wet chemicals and uncured resins.

9.4 Chemical hazards

Special precautions should be taken when working in contact with resins, curing agents, catalysts, etc. Extreme irritation may result from direct contact with skin and also from inhalation. Installers should observe strict personal hygiene at all times with respect to the handling of these products when in the uncured liquid state. Smoking, eating and drinking are prohibited during handling and storage of resin, paste, adhesives or other chemicals.

Peroxide curing agents used with vinyl ester and polyester resins are especially harmful to eyes. Even small quantities can cause permanent damage. Eye protection must be worn when handling peroxides. Eye protection is recommended when handling all curing agents. Contact with the skin can be prevented by the use of latex gloves and barrier creams. Skin areas that are contaminated should be immediately and thoroughly washed with soap and water.

The use of oxygen or fresh-air masks is recommended when installers are exposed to extreme dust or noxious gases for prolonged periods in confined spaces or any space where ventilation is poor.

9.5 Dust Hazards

The use of a dust mask and protective clothing is recommended during cutting and sanding of fiberglass grating to prevent inhalation of the glass-fiber dust and to prevent skin irritation. Well ventilated rooms or open air spaces are advised to minimize contact with dust. Ventilation systems for fabrication areas should

include a portable dust extraction unit that can be used as close as possible to the work.

Revision Summary

31 January 2005

New Saudi Aramco Engineering Procedure.