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Guidance on Industry Standard for Skid Mounted Units Procurement

GIS 40-101

BP GROUP
ENGINEERING TECHNICAL PRACTICES

Foreword

This is the first issue of Engineering Technical Practice (ETP) BP GIS 40-101. This Guidance on Industry Standard (GIS) is based on the following heritage documents from merged BP companies:

Amoco

A PE-SMU-00-P

Packaged Equipment Skid Mounted Units Procurement Specification

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1. Scope

- a. This GIS provides guidance on health, safety and environmental legislation, good design practice, and technical and economic considerations for skid mounted units. The design information included in this specification is not intended to cover complete details. The guideline outlines regulations, design considerations, and recommends a configuration which can be scaled to adapt to the specific facilities which can differ due to layouts and production capacity.
- b. This standard is intended to guide the purchaser in the use or creation of a fit-for-purpose specification for enquiry or purchasing activity.
- c. This document may refer to certain local, national or international regulations but the responsibility to ensure compliance with legislation and any other statutory requirements lies with the user. The user shall adapt or supplement this document to ensure compliance for the specific application.

2. Normative references

The following normative documents contain requirements that, through reference in this text, constitute requirements of this technical practice. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this technical practice are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

American Institute of Steel Construction (AISC)

AISC S326	Specification for the Design, Fabrication and Erection of Steel for Buildings
AISC S329	Allowable Stress Design Specification for Structural Joints Using ASTM A325 or A490 Bolts
AISC S335	Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design

American Petroleum Institute (API)

API RP 2A-LRFD	Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms—Load and Resistance Factor Design
API RP 2A-WSD	Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms—Working Stress Design
API SPEC 5L	Specification for Line Pipe
API RP 551	Process Measurement Instrumentation
API STD 660	Shell-and-Tube Heat Exchangers for Refinery Service
API STD 661	Air-Cooled Heat Exchangers for General Refinery Service

American Society of Civil Engineers (ASCE)

ASCE 7	Minimum Design Loads for Buildings and Other Structures
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American Society of Mechanical Engineers (ASME)

ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B31.3	Chemical Plant and Petroleum Refinery Piping
ASME BPVC	Boiler and Pressure Vessel Code; SEC VIII D1, Rules for Construction of Pressure Vessels, Division 1; SEC IX, Qualification



Standard for Welding and Brazing Procedures, Welders, Brazers,
and Welding and Brazing Operators

American Society for Testing and Materials (ASTM)

ASTM A36 / A36M	Standard Specification for Structural Steel
ASTM A53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A106	Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products (AASHTO M111)
ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware (AASHTO M232)

American Welding Society (AWS)

AWS D1.1	Structural Welding Code Steel
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GIS 40-102	Skid Mounted Units Lifting and Rigging Requirements
GP 12-25	Earthing / Grounding
GP 40-10	Structural Skids and Skid Mounted Units Guide

Illumination Engineering Society (IES)

IES Lighting Handbook	
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National Electrical Manufacturer's Association (NEMA)

NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum)
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National Fire Protection Association (NFPA)

NFPA 70	National Electrical Code (NEC)
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Occupational Safety & Health Administration (OSHA)"

29 CFR, Part 1910	Walking-Working Surfaces, Subpart D
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US Department of the Interior (DOI), Minerals Management Service (MMS)

30 CFR Part 250	Oil and Gas and Sulfur Operations in the Outer Continental Shelf
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Uniform Building Code (UBC)

3. Definitions

dead loads

Loads which are permanent parts of the structure such as empty permanent equipment, empty pipe, cable and conduit, grating, instruments, valves, structural members, hand rails and platforms.

erection loads

Loads which are temporary forces caused by erection of structures or equipment.

fluid loads

Weight of operating or hydrotest fluid in equipment and pipe (whichever is larger).

impact loads

Loads which are an equivalent static force caused by a moving object.



live loads

Loads which are temporary in nature such as occupants, repair and maintenance tools/equipment.

maintenance loads

Loads which are temporary forces caused by the dismantling, repair or painting of equipment.

padeye

A small fitting with a hole, used to provide a fairlead, or guide a line; a metal eye on a small plate to which blocks, lines and other objects are shackled.

seismic loads

Forces associated with acceleration of the skids as it is supported on the offshore deck during a seismic event.

transportation loads

Forces associated with pitching, rolling and heaving when a skid is aboard an offshore transport vessel.

thermal loads

Thermal Loads are those forces caused by a change in temperature which may result from both operating and environmental conditions. Such forces shall include those caused by vessel or piping expansion or contraction and structures' expansion or contraction.

vibration loads

Loads which are those forces caused by vibrating machinery such as pumps, blowers, fans and compressors. Included are surge forces similar to those acting in fluid cokers, hydroformers, crackers and pipe.

wind loads

Minimum design wind loading for skids shall be based on 110 mph. Force coefficients and loads shall be per API-RP 2A.

4. Abbreviations

For the purpose of this GIS, the following abbreviations apply:

AWG	American Wiring Gauge
DC	Direct Current
LRFD	Load and Resistance Factor Design
NDT	Non Destructive Test
NPS	Nominal Pipe Size
OD	Outer Diameter
PVC	Poly Vinyl Chloride
RTD	Resistance Temperature Detector
WSD	Working Stress Design



5. Skid requirements

5.1. General

- a. Unless otherwise approved by Company, outside skid dimensions shall not exceed 12.2 m (40 ft) long by 3.7 m (12 ft) wide by 4.3 m (14 ft) high.

The width and length of skids are normally dependent on the intermediate and final modes of transportation. Skid width may be determined by the local requirements of roadways or the width of the bay of a cargo ship hold. The height if transported by truck on roads is determined by the height of overpasses and overhead electrical power lines. Special permitting may alleviate the height restrictions as some obstacles like overhead power lines can temporarily be removed. If a skid is built on the coast of an ocean or major water way and the facility is offshore or near shore, then the possibility is that a barge could be used and height and width restrictions may be increased.

- b. Skid mounted equipment, piping, vessels, and other components shall be within confines of skid outer edge. See GP 40-10.

5.2. Arrangement

- a. Equipment shall be mounted and installed in accordance with manufacturer's recommendations. Skid shall be:
 - 1. Rectangular.
 - 2. Designed such that equipment may be removed or maintained.
 - 3. All grating panels shall span in the same direction and shall be removable.
- b. Piping and instrumentation systems shall be designed to enable isolation and removal of equipment, including:
 - 1. Isolation block valves and spool pieces (or unions) without bending or cutting pipe.
 - 2. Drainable piping systems.
 - 3. Skid piping tie-ins flanged and piped to skid edge.
- c. Access shall be provided to accomplish daily operating tasks and routine maintenance from skid edge or through open areas with walkways, platforms, or both as follows:
 - 1. Stairs, ladders, cages, platforms, handrails, etc., shall be provided as required, and shall conform to the following requirements as well as those of the local country regulations similar to OSHA.
 - 2. Instrumentation panels and local gauge boards shall be accessible from one side of skid or centralized in an open access area.
 - 3. Manual valves, switches, pushbuttons, and other devices required for daily operation shall be located within convenient reach of skid edge or an open access area.
 - 4. Access areas with walkways or platforms shall be free of tripping hazards, overhead obstructions, dead ends, and constricted passageways.

6. Structural design

6.1. General

- a. USA codes and standards are stated by this GIS however, equivalent European or local country codes and standards may be used if agreed by BP.



- b. Structural design shall be performed in accordance with AISC S326, S329, and S335, as applicable. API RP 2A shall apply for offshore installations.
- c. Minimum design loads shall be determined in accordance with ASCE 7. Seismic loads shall be in accordance with ASCE 7 or Uniform Building Code.
- d. Wind loads shall be based on:
 - 1. Importance factor of Category III.
 - 2. Velocity pressure and gust response factor of exposure C for inland and coastal and exposure D for offshore installations.
- e. Design considerations shall include:
 - 1. Location (land or marine).
 - 2. Equipment static and dynamic loads.
 - 3. Foundations, tie-downs, or anchorage.
- f. Skid installations shall be sufficiently rigid to prevent damage during fabrication, assembly, transportation, or installation.
 - 1. Skid assemblies with rotating equipment as major components shall be designed with a maximum deflection value of 0.025 mm per 25.4 mm (0.001 inch per inch) of skid length for loading conditions.
 - 2. Other skids shall be designed with a maximum deflection value of $L/300$, where L is skid length.
- g. Skid structures shall be designed for the most severe effect of the following loads during:
 - 1. Fabrication, assembly, and hydrostatic / pneumatic test.
 - 2. Transportation (land, sea, or air).
 - 3. Lifting and skidding on concrete supports or platform deck.
 - 4. Service, including effects of vibration, impact, and fatigue.

6.2. Design loads

6.2.1. General

- a. Loads which are permanent parts of structures such as equipment, empty pipe and vessels, etc. shall be classified as dead loads or empty loads. Loads which are temporary, such as occupants, repair / maintenance tools, cranes, equipment and loose parts or as specified by a code or standard shall be classified as live load loads. Wind load, seismic load, snow, rain, soil active or passive pressures, thermal or hydraulic loads shall be those loads specified herein for the processing facilities, and constitute live loads.
- b. Unless otherwise specified by Company, skid shall be designed as a simple beam supported at the extreme ends. Loads shall include:
 - 1. Skid dead loads.
 - 2. Equipment.
 - 3. Piping and supports.
 - 4. Piping reactions.
 - 5. Fluid loads.
 - 6. Live loads
- c. A factor of 1.1 shall be applied to loads.

