

GP 04-01-03	Design Loads for Structures	July 2003
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Design Loads for Structures

GP 04-01-03

Scope

[I] This Global Practice (GP) covers the loads for the design of support structures, equipment, and other facilities. The loads include gravity (dead and live) loads, process-generated loads, wind, and earthquake.

[I] An asterisk (*) indicates that additional information is required. If a job is contracted, this additional information is furnished in the Job Specifications.

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1. Required References

- 1) [I] This Section lists Codes and Standards that are generically referenced and assumed to be a part of this document. Unless otherwise specified herein, use the latest edition.

1.1. ASCE–American Society of Civil Engineers

ASCE 7	Minimum Design Loads for Buildings and Other Structures
"Wind Loads and Anchor Bolt Design for Petrochemical Facilities." 1997. American Society of Civil Engineers. (ASCE Stock # 40262)	

- 2) [I] Local codes and standards may be substituted for the ones referenced herein provided the following provisions are met:
- The resultant design meets the safety and serviceability criteria attained through this Practice.
 - Substitution is accepted by the authorities where the facility is to be located and by the Owner's Engineer.

2. Additional References

[I] The following Practices and Standards shall be used with this Practice as applicable.

2.1. Global Practices–ExxonMobil Engineering Practices

GP 04-01-04	Surge Vibration Design Loads
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2.2. AASHTO–American Association of Highway and Transportation Officials

AASHTO HB16	Standard Specifications for Highway Bridges
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2.3. AISC–American Institute of Steel Construction

AISC M020L	LRFD Manual of Steel Construction
AISC S335	ASD Manual of Steel Construction
AISC 335-89s1	Supplement No. 1 to the Specification for Structural Steel Buildings, Allowable Stress Design and Plastic Design



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2.4. API–American Petroleum Institute

API STD 620	Design and Construction of Large, Welded, Low-Pressure Storage Tanks
API STD 650	Welded Steel Tanks for Oil Storage

[I] Local codes and standards may be substituted for the ones referenced herein provided the following provisions are met:

- 1) The resultant design meets the safety and serviceability criteria attained through this Practice.
- 2) Substitution is accepted by the authorities where the facility is to be located and by the Owner's Engineer.

3. Design

3.1. General

- 1) [I] The following basic loads that shall be considered in the structural design include:
 - a) Dead loads.
 - b) Live loads.
 - c) Operating loads including fluid, impact, piping restraint, surge vibration, thermal, and vibration loads.
 - d) Maintenance loads including bundle pull loads.
 - e) Environmental loads including earthquake, snow, ice, rain, and wind loads.
 - f) Construction loads including erection forces and transportation loads.
- 2) [I] Basic loads shall be as defined in ASCE 7 except as clarified and supplemented below:
 - a) Live loads include the following loads:
 - i) Personnel, portable machinery, tools, and equipment.
 - ii) Material to be temporarily stored during maintenance, such as exchanger parts, pipe and fittings, valves.
 - iii) Material normally stored during operation such as tools, maintenance equipment, catalyst, and chemicals.
 - b) Fluid loads are the gravity loads resulting from liquid, solids such as packing, catalyst or inerts, or fluidized solid materials in equipment and piping during operation or hydrotest.
 - c) Piping restraint loads are forces on pipe anchors and guides resulting from thermal expansion, surge, or internal pressure of the piping.
 - d) Impact loads are loads that account for the dynamic effects from moving equipment such as traveling cranes, elevators, hoists, and vehicular traffic.
 - e) Bundle pull load is force resulting from the removal of a tube bundle from a heat exchanger.
 - f) Surge vibration loads are lateral inertia forces caused by the surging action of fluidized solids.
 - g) Construction loads are temporary loads caused by the erection and construction of structures and equipment, such as loading from guy rigging, shoring, etc.

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- h) Transportation loads are inertial loads caused by the movement of structures and equipment from a fabrication site to the installation site.
- 3) [I] Basic loads shall be determined according to the applicable codes and standards listed in Sections 1 and 2 as modified or supplemented herein.

3.2. Live Loads

- 1) [R] Minimum live loads which shall be used to design structural elements and appurtenances shall be per ASCE 7 except as modified in Table 1.

Table 1: Minimum Live Loads

Component Design	Loaded Area	Minimum Live Load ⁽¹⁾
Floor Plate, Grating and Slabs	1. Walkways and Access Platforms	100 psf (4.8 kN/m ²)
	2. Platforms for Operating Storage or Maintenance Storage Loads.	125 psf (6.0 kN/m ²)
Floor Framing and Bracing	1. Walkways and Access Platforms	60 psf (2.9 kN/m ²) or a Moving Concentrated Load of 1000 lb (4.4 kN)(1)
	2. Platforms for Operating Storage or Maintenance Storage Loads.	125 psf (6.0 kN/m ²)
Columns and Brackets	1. Walkways and Access Platforms	60 psf (2.9 kN/m ²) or a Moving Concentrated Load of 1000 lb (4.4 kN)(1)
	2. Platforms for Operating Storage or Maintenance Storage Loads.	125 psf (6.0 kN/m ²)
Roof (Sloped or Flat)	—	20 psf (1.0 kN/m ²)
Note (1): May be reduced based on influence area per ASCE 7.		

3.3. Wind Loads

- 1) [I] Wind loads shall be calculated based on procedures provided in ASCE 7 with the following additions/clarifications.
- * Basic wind speed (V) and importance factor (I) shall be as specified by the Owner.
 - Exposure Category C shall be used unless the terrain condition of the site justifies a different exposure category subject to the approval of the Owner.
 - Gust effect factors for flexible building and structures may be calculated by alternate methods acceptable to the Owner. A building or structure shall be considered flexible only if it has a fundamental natural frequency less than 1Hz.
 - Force coefficients (C_f) for typical petrochemical facilities not specifically covered by ASCE 7, such as multiple-bay open-frame structures containing equipment, pipe racks, vessel with appurtenances, etc., shall be determined based on guidelines provided in ASCE report "Wind Loads and Anchor Bolt Design of Petrochemical Facilities."

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