

GP 17-05-01	Human Factors in Plant Design	November 2002
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Human Factors in Plant Design

GP 17-05-01

Scope

- 1) [I] This Global Practice (GP) lists human factors requirements and considerations for the design and installation of equipment in petroleum and chemical facilities. The objectives of these requirements are to reduce risk of injury, specifically musculoskeletal disorders, and to minimize process upsets caused by human error.
- 2) [I] The focus of this GP is the interaction of personnel with plant equipment in the following order:
 - a) Access for safe task performance
 - b) Controls and displays
 - c) Alarms
 - d) Signs, labels and color coding
 - e) Workplace environment
- 3) [I] An asterisk (*) indicates that additional information from the Owner's Engineer, or approval by the Owner's Engineer is required.

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Documents

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Table of Contents

Table of Figures	3
Table of Tables.....	4
1. Required References.....	5
1.1. ANSI–American National Standards Institute	5
1.2. ASSE–American Society of Safety Engineers	5
1.3. ISA–The Instrumentation, Systems, and Automation Society	5
1.4. ISO–International Organization for Standardization	5
2. Additional Requirements	5
2.1. Global Practices–ExxonMobil Engineering Practices	5
3. Definitions	9
3.1. Terms.....	9
3.2. Acronyms	10
4. Access for Safe Task Performance.....	10
4.1. Equipment Layout	10
4.2. Platforms, Stairs and Ladders.....	11
4.3. Clearance.....	11
4.4. Access to Equipment	12
5. Controls and Displays.....	14
5.1. Local Controls and Displays	14
5.2. Local Control Panels and Control Consoles	18
5.3. Control Room Video Display Units.....	20
5.4. Control Room Layout.....	22
6. Alarms.....	23
7. Signs, Labels and Color Coding	23
8. Workplace Environment.....	26
Record of Change	27
Attachment: Purpose Codes Definitions	28

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Page 2 of 28	©ExxonMobil Development Company	



GP 17-05-01	Human Factors in Plant Design	November 2002
-------------	-------------------------------	---------------

Table of Figures

Figure 1: Location of Controls and Displays on Local Control Panels	15
Figure 2: Location of Controls and Video Display Units on Control Consoles	19
Figure 3: Hazard Warning Signs	26

DNST, CHEM, PL	For ExxonMobil Use Only	Version 2.0.0
Page 3 of 28	©ExxonMobil Development Company	



Documents

Document Sharing Hub

Table of Tables

Table 1: Control Function Selection 16
Table 2: Display Function Selection 17
Table 3: Sign and Label Format ⁽¹⁾.....24

1. Required References

[I] This Section lists Practices 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. ANSI–American National Standards Institute

ANSI Z35.1	(Withdrawn) Specifications for Accident Prevention Signs
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1.2. ASSE–American Society of Safety Engineers

ASSE/SAFE A14.3	Safety Requirements for Fixed Ladders
ASSE/SAFE A1264.1	Safety Requirements for Workplace Floor and Wall Openings, Stairs, and Railings Systems

1.3. ISA–The Instrumentation, Systems, and Automation Society

ISA 5.5	Graphic Symbols for Process Displays
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1.4. ISO–International Organization for Standardization

ISO 3511-I	Process Measurement Control Functions and Instrumentation - Symbolic Representation - Part I: Basic Requirements First Edition
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2. Additional Requirements

* [I] The following Practices shall be used with this Practice as specified by Purchaser.

2.1. Global Practices–ExxonMobil Engineering Practices

GP 01-01-01	Drawings, Diagrams, and Line Lists
GP 02-01-01	Plant Noise Design Criteria
GP 03-02-04	Pressure Relieving Systems
GP 03-02-07	Manual Sampling Systems
GP 03-03-02	Suction and Discharge Piping for Centrifugal Pumps
GP 03-03-03	Flushing and Drain Piping for Centrifugal and Rotary Gas Compressors
GP 03-03-05	Suction, Discharge, and Interstage Piping for Reciprocating Compressors

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Page 5 of 28	©ExxonMobil Development Company	



GP 17-05-01	Human Factors in Plant Design	November 2002
-------------	-------------------------------	---------------

GP 03-03-07	Inlet and Exhaust Piping for Steam Turbines
GP 03-03-10	Strainers for Mechanical Equipment
GP 03-04-01	Piping for Fired Equipment
GP 03-05-01	Fill and Discharge Lines, and Auxiliary Piping for Storage Tanks and Vessels
GP 03-06-01	Piping for Instruments
GP 03-06-02	Piping at Control and Protective System Valve Stations
GP 03-06-03	Utility Connections to Piping and Equipment
GP 03-07-01	Piping Layout, Supports, and Flexibility
GP 03-12-01	Valve Selection
GP 03-16-01	Flanged Joints, Gaskets, and Bolting
GP 03-18-01	Piping Fabrication Shop or Field
GP 04-01-02	Structural Steel Design
GP 04-01-03	Design Loads for Structures
GP 04-02-01	Auxiliary Structures for Operation and Maintenance
GP 04-02-02	Pipe Supports
GP 04-03-01	Plant Buildings for Operation and Storage
GP 05-01-01	Pressure Vessels
GP 05-02-01	Internals for Towers, Drums, and Fixed Bed Reactors
GP 06-04-01	Air-Cooled Heat Exchangers
GP 07-01-01	Fired Heaters
GP 07-02-01	Industrial Boilers
GP 07-04-01	Burners for Fired Heaters
GP 07-08-01	Dampers and Guillotines for Fired Equipment
GP 07-10-01	Elevated Flare Tips
GP 08-01-01	Cooling Towers
GP 09-01-01	Spacing and Dikes for Storage Vessels and Tanks
GP 09-02-01	Additional Requirements for Pressure Storage Spheres
GP 09-06-01	Refrigerated Storage Tanks
GP 09-07-01	Accessories for Atmospheric Storage Tanks
GP 09-07-04	Internal Floating Roofs for Atmospheric Storage Tanks
GP 10-01-01	Centrifugal Pumps

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Page 6 of 28	©ExxonMobil Development Company	



Documents

Document Sharing Hub

GP 17-05-01	Human Factors in Plant Design	November 2002
-------------	-------------------------------	---------------

GP 10-01-03	Shaft Sealing Systems for Centrifugal and Rotary Pumps
GP 10-02-02	Positive Displacement Pumps - Rotary
GP 10-03-01	Special Purpose Centrifugal Compressors
GP 10-03-02	Packaged, Integrally Geared Centrifugal Air Compressors
GP 10-03-03	Rotary Screw Compressors
GP 10-03-04	Axial Compressors for Air Service
GP 10-04-01	Reciprocating Process Compressors
GP 10-07-02	Special Purpose Steam Turbines
GP 10-08-01	Combustion Gas Turbines
GP 10-09-01	Mechanical Agitators
GP 10-13-01	Special Purpose Centrifugal Fans
GP 10-13-02	General Purpose Centrifugal Fans
GP 10-14-01	Lube and Seal Oil Systems for Machinery
GP 14-01-01	External Insulation
GP 14-03-01	Fireproofing
GP 15-01-01	Instrumentation for Fired Heaters
GP 15-01-02	Instrumentation for Compressors and Drivers
GP 15-01-03	Instruments for Storage Tanks and Vessels
GP 15-02-01	Temperature Instruments
GP 15-03-01	Pressure Instruments
GP 15-04-01	Flow Instruments
GP 15-05-01	Level Instruments
GP 15-06-01	Electronic and Pneumatic Instruments
GP 15-06-03	Programmable Logic Controllers
GP 15-07-01	Electric Power Branch Circuit Design for Instrumentation
GP 15-07-02	Protective Systems
GP 15-07-03	Alarm Systems
GP 15-08-01	Process Stream Analyzers
GP 15-08-02	Sample Transport and Sample Conditioning Systems for Process Stream Analyzers
GP 15-08-03	Combustible and Toxic Vapor Detection Systems
GP 15-09-01	Control Valves

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Page 7 of 28	©ExxonMobil Development Company	



Documents

Document Sharing Hub

GP 17-05-01	Human Factors in Plant Design	November 2002
-------------	-------------------------------	---------------

GP 15-09-02	Electric Motor Operators for Valves
GP 15-10-01	Instrument Transmission Systems
GP 15-11-01	Instrument Control Panels
GP 15-12-01	Instrument Wire and Cable
GP 16-02-01	Power System Design
GP 16-04-01	Grounding and Overvoltage Protection
GP 16-05-01	Lighting
GP 16-05-02	Security Lighting of Plants
GP 16-06-01	Substation Layout
GP 16-07-01	Motor Application
GP 16-08-01	Instrument and Essential Services Power Supplies
GP 16-09-01	Low Voltage AC Motors Up to 200 HP (150 kW)
GP 16-09-02	AC Motors: Medium Voltage and Low Voltage Over 200 HP (150 kW)
GP 16-09-03	Synchronous Generators
GP 16-10-01	Power Transformers
GP 16-12-01	Switchgear, Control Centers, and Bus Duct
GP 16-12-02	Secondary Selective Substations with Residual Voltage Based Automatic Transfer
GP 16-14-01	Standard LV Variable Frequency Drives
GP 16-14-02	Engineered Variable Frequency Drive Systems
GP 17-01-01	Firefighting Equipment
GP 17-03-01	Emergency Shower and Eyewash Facilities
GP 19-01-01	Paint and Protective Coatings
GP 19-06-01	Facilities for Corrosion Monitoring in Process Equipment
GP 20-01-01	Inspection of Equipment and Materials
GP 20-01-03	Quality Programs

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3. Definitions

3.1. Terms

Term	[I] Description
access	An approach to equipment for reaching, inspecting or removing it, characterized by sufficient space to allow unobstructed movement of the body and by acceptable reach of personnel interacting with it.
accessible from grade	Characterized by maximum horizontal reach of 20 in. (510 mm) or overhead grip reach of 6 ft (1800 mm) when standing at grade level or on the top of rolling stairs. Typically the maximum elevation of the stairs platform is approximately 4 ft (1200 mm) so its railing can pass below pipes and structures.
anthropometric data	Data on human body sizes and dimensions to design or assess the appropriate size of equipment for access and reach purposes.
clearance	Space allowed for the passing of two parts, as it relates to headroom, knee room, elbowroom, and access through passageways, around and between equipment.
controls	Devices an operator uses to change the status of equipment or process.
critical valve	An emergency block valve (EBV).
displays	Devices informing an operator about the status of equipment or process.
functional grouping	A group or cluster of controls and displays that are all related to a particular system.
glare	Dazzling brightness within the field of vision that causes annoyance, discomfort, or loss of visual performance and visibility.
horizontal reach	The distance a specified group of people would be expected to reach, measured from the shoulder to the fingertips with the arm extended out in a horizontal plane.
input dialogue	Means of interaction between an operator and the control system, such as menus, direct interaction with graphics, typed commands, and selection of function keys.
label	A placard displaying several words and a code that is used to identify equipment or components.
link analysis	A technique to identify and optimize the links between system components in terms of order, frequency and priority of use by the operator.
operational frequency for valves	The following terms used in GPs infer the indicated frequency of use: a. Operating valve—at least four times a year. b. Frequently operated valve—more than twice a month.