MANUAL

GUIDE FOR THE SELECTION OF HOISTING FACILITIES AND WEATHER PROTECTION FOR ROTATING EQUIPMENT

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DESIGN AND ENGINEERING PRACTICE

USED BY

COMPANIES OF THE ROYAL DUTCH/SHELL GROUP

PREFACE

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NOTE: In addition to DEP publications there are Standard Specifications and Draft DEPs for Development (DDDs). DDDs generally introduce new procedures or techniques that will probably need updating as further experience develops during their use. The above requirements for distribution and use of DEPs are also applicable to Standard Specifications and DDDs. Standard Specifications and DDDs will gradually be replaced by DEPs.

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1. INTRODUCTION

This manual indicates the main factors on which a decision should be taken on whether to provide, or omit, hoisting facilities complete with a covering roof or to install essential rotating equipment in the open air.

Following the selection, hoisting facilities and covering shall be designed, installed, and operated in strict accordance with safe engineering practice.

This manual is intended for use in oil refineries, chemical plants, gas plants and, where applicable, in exploration, production and new ventures.

Unless otherwise authorized by SIPM, the distribution of this manual is confined to companies belonging to or managed by the Royal Dutch/Shell Group and to contractors nominated by them under cover of a secrecy agreement.

All publications referred to in this manual are listed in Section 5.

Where cross references are made, the number of the section or sub- section referred to is shown in brackets.

2. DEFINITION

For the purpose of this manual the following definition shall hold:

Shall and **Should** - the word `shall' is to be understood as mandatory and the word `should' as strongly recommended to comply with the requirements of this manual.

3. CLASSIFICATION OF EQUIPMENT

The four most important factors affecting a decision on whether to provide permanent roofing, with or without side walls and hoisting facilities above rotating equipment, or to install the equipment in the open air are:

1. The category to which an item of rotating equipment belongs.
2. The local climatic conditions.
3. The location of the equipment in the plant.
4. Economic considerations.

3.1 CATEGORIES OF ROTATING EQUIPMENT

The following categories can be distinguished.

Category 1

Multi-stage turbo machines generally built in accordance with API Standards 612, 616 and 617, such as turbo compressors, turbo generators, gas-turbine driven compressors, etc., having a `maintenance' weight of the heaviest part greater than 1000 kg and/or a power rating greater than 5000 kW.

Category 2

Multi-stage turbo machines, without an installed spare, built to the same standards as Category 1 but having a `maintenance' weight of the heaviest part, up to and including 1000 kg and/or a power rating up to and including 5000 kW.

Category 3

a) Those items of rotating equipment described under Category 2, but having an installed spare.

b) Turbo compressors and turbo generators built in accordance with API Standards 611 and 617.

c) Electric-motor-driven multi-stage compressors in accordance with API Standard 617.

d) Reciprocating compressors in accordance with API Standard 618.

e) Diesel/gas-engine-driven compressors, generators, pumps having a power rating up to and including 250 kW.

Category 4

Auxiliary and general-purpose equipment of types normally falling outside Categories 1, 2 and 3, e.g. pumps in accordance with API Standard 610, including fire-fighting water pumps.

3.2 CLIMATIC CONDITIONS

In respect of the degree of protection required for the equipment and the maintenance area in relation to climatic conditions, the following climatic conditions can be distinguished:

- cold to moderate with periodical winds, rain, frost and snow
- desert with periodical sand storms
- tropical with monsoon-type rainfall
- tropical and dry
- off-shore marine - cold climate
- off-shore marine - tropical climate.

3.3 WEIGHT TO BE LIFTED

The type of hoisting facilities provided will have an influence on the time required to carry

out maintenance activities and thus are linked to the category of the equipment.

The weight of the parts to be lifted and whether equipment is to be completely stripped at site shall be taken into account in the selection of the hoisting gear.

The following permanent hoisting facilities are considered:

A. Electric/pneumatic overhead travelling crane.

B. Overhead travelling crane, chain-driven with electric/pneumatic/chain hoist.

C. Jib crane with an electric/pneumatic hoist.

D. Hoist beam with an electric/pneumatic hoist.

E. Hoist beam with trolley for a chain block.

F. Special lifting equipment such as special hosts, jacking equipment, cradles, etc., which may for example be used for the removal/manoeuvring of hot gas generators out of gas turbine enclosures or any other special lifting device required to facilitate maintenance.

3.4 LOCATION OF THE EQUIPMENT

The location of the equipment in the plant and its accessibility for maintenance by mobile cranes shall also be considered in the selection and specification of hoisting facilities.

4. ECONOMIC CONSIDERATIONS

Consideration shall be given to whether a planned overhaul is normally expected or whether there is a real chance of an emergency breakdown.

For a planned overhaul or internal inspection, the necessary protection and hoisting facilities can be prepared well in advance and sufficient time is also available for restoring the unit to its original weatherproof state, so that it is again suitable for outdoor use.

Experience has shown that the equipment belonging to Categories 1 and 2 which cover equipment mostly controlled by and varying with processes, is by its very nature more sensitive and therefore has a greater chance of breaking down.

Permanently available overhead cranes and protection shorten the repair time. If rotors have to be lifted or fitted with the help of a mobile crane, damage to the rotor or labyrinths is more likely to occur as all movements are less controllable. Equipment of Categories 1 and 2 should be provided for that reason with suitable permanent hoisting facilities. These hoisting facilities, preferably electrically driven, should have the following capabilities:

hoisting speed slow	between 0.30	-	0.40 m/min + jog facility
hoisting speed fast	between 4.5	-	5.5 m/min
traverse travelling speed	between 10	-	-8 m/min + jog facility
travelling speed	between 18	-	15m/min + jog facility

The slower speeds shall apply for a lifting weight of 15 tons or more.

When permanent hoisting facilities with associated steel structures are provided, there is no economic justification for omitting a simple roof cover in such a case, provided that the roof remains very simple and sophisticated constructions are not required.

In severe climates, e.g. cold, desert environment, hot tropical with rainfall, a roof with sidewalls, partly open to allow disposal of dangerous gases, will give better protection for machinery and maintenance crew.

The ultimate selection of the hoisting facilities shall be subject to agreement by the principal.

5. SELECTION GUIDE FOR HOISTING FACILITIES

Category	CLIMATIC CONDITIONS				Remarks
	Off-shore marine		**Off-shore marine**	**Off-shore marine**	
	Cold to moderate with periodical rain, frost and snow	**Desert with periodical sand storms**	**Tropical with monsoon-type rainfall**	**Tropical dry**	**General: The hazardous area classification shall be considered in the selection of the hoisting equipment. See IP Safety Code.**
1	- electric or pneumatic overhead travelling crane (3.3.A) - special lifting equipment (3.3.F) - roof and (partly* open) side walls *partly louvre type			- electric or pneumatic overhead travelling crane (3.3.A) - special lifting equipment (3.3.F) - simple roof with partly * side walls * partly louvre type	- 3.3.F only when applicable - when required by the area classification a pneumatic overhead travelling crane shall be selected for off-shore installations only
2	- overhead travelling crane, chain-driven with electric, pneumatic or chain hoist (3.3.B) - special lifting equipment (3.3.F) - roof and (partly* open) side walls * partly louvre type			- overhead travelling crane, chain-driven, with electric, pneumatic or chain hoist (3.3.B) - special lifting equipment (3.3.F) simple roof with partly* side walls * partly louvre type	- 3.3.F only when applicable - when required by the area classification a pneumatic overhead travelling crane shall be selected for off-shore installations only
3	- overhead travelling crane, chain-driven with electric, pneumatic or chain hoist (3.3.B) - jib crane with electric/pneumatic hoist (3.3.C) - one hoist beam with electric hoist/pneumatic hoist or chain block (3.3.D) - special lifting equipment (3.3.F)			- overhead travelling crane, chain-driven with electric, pneumatic, or chain hoist (3.3.B) - jib crane with electric/pneumatic hoist (3.3.C) - one hoist beam with electric/pneumatic hoist or chain block (3.3.D) - special lifting equipment (3.3.F)	- turbo machines and reciprocating compressors, without installed spares, should be provided with a simple roof - reciprocating compressors with installed spares may be installed in the open air. If not accessible by a mobile crane and the 'maintenance' weight is greater than 100 kg a jib crane/hoist beam shall be provided - all internal combustion engine units should be under a simple roof or be in an enclosure. If cylinders are in line and 'maintenance' weight is greater than 100 kg, a hoist beam shall be provided. - If the engine is V-form and/or integral with a compressor and the power rating is greater than 250 kW, a chain-driven overhead travelling crane shall be provided. - 3.3.F only when applicable
4	- one hoist beam for chain block (3.3.E) - special lifting equipment (3.3.F)			- one hoist beam for chain block (3.3.E) - special lifting equipment (3.3.F)	- if the equipment is located such that a small wheeled hydraulic crane cannot be manoeuvred around the equipment - if the maintenance weight is greater than 100 kg - if not accessible by mobile crane - 3.3.F only when applicable

The above crane selection tables states order of preference

6. REFERENCES

In this manual reference is made to the following publications.

NOTE: The latest issue of each publication shall be used together with any amendments/supplements/revisions to such publications.

It is particularly important that the effect of revisions to international, national or other standards shall be considered when they are used in conjunction with DEPs, unless the standard referred to has been prescribed by date.

AMERICAN STANDARDS

Centrifugal Pumps for General Refinery Services	API Std 610
General-Purpose Steam Turbines for Refinery Services	API Std 611
Special-Purpose Steam Turbines for Refinery Services	API Std 612
Combustion Gas Turbines for General Refinery Services	API Std 616
Centrifugal Compressors for General Refinery Services	API Std 617
Reciprocating Compressors for General Refinery Services	API Std 618

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IP Model Code of Safe Practice in the Petroleum Industry Safety Code	Part I - Electrical Safety Code

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