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SPECIFICATIONS FOR PUMP INSPECTION

(PROJECT STANDARDS AND SPECIFICATIONS)

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SCOPE

This Project Standards and Specification covers the requirements for inspection, maintenance, commissioning and testing procedures for the following Rotary Equipment used in the Oil Industry:

I. Centrifugal Pumps (Horizontal/ Vertical, Both ends supported/ overhanging type, Single/ Multi stage and Submersible type)
II. Positive Displacement Pumps (Reciprocating Pumps, Gear Pumps, Screw Pumps and Dosing Pumps).

REFERENCES

Throughout this Standard, the following dated and undated standards and codes are referred to. These referenced documents shall, to the extent specified herein to form a part of this standard.

— *API 610 Centrifugal Pumps for General Refinery Services*
— *API 674 Positive Displacement Pump- Reciprocating*

DEFINITION AND TERMINOLOGY

— OD – Outer diameter of bearing
— ID – Inner diameter of bearing

GENERAL

Introduction

The rotary equipment plays a vital role in hydrocarbon processing industry. Timely inspection and maintenance of rotary equipment will go a long way in ensuring safer operations of the installations in Oil Industry. The schedules given in this standard are very broad based on present experience and practices and may be modified from time to time. The schedules indicate the maximum interval of time between two inspections. Organisations having historical records and analysis of failures may alter the inspection interval accordingly.

PREDICTIVE MAINTENANCE SCHEDULE FOR CENTRIFUGAL PUMPS

The condition of centrifugal pump can be assessed by measurement of vibration and shock pulse levels of antifriction bearings. The frequency of measurement shall depend on the criticality of the equipment.

PREVENTIVE MAINTENANCE INSPECTION SCHEDULE FOR CENTRIFUGAL PUMPS

Centrifugal Pumps are classified in the following groups for preparation of preventive maintenance inspection schedule:

I. Horizontal Centrifugal Pumps (both ends supported)
II. Horizontal Centrifugal Pumps (overhanging type)
III. Vertical Centrifugal Pumps
IV. Submersible Pumps

Checklist on inspection items for each type of pumps shall be as per the schedule given below.

I. HORIZONTAL CENTRIFUGAL PUMPS (BOTH ENDS SUPPORTED)

All the following items shall be checked or recorded after the specified period:

1. After 1000 running hours or 3 months whichever earlier

   i. Bearing lubricant (for water contamination and sediments)
   ii. Oil ring for performance
   iii. Deflector for looseness
   iv. Constant level oiler for leakage
   v. Mechanical seal for leakage
   vi. Seal flushing/ quenching system (of mechanical seal) for clogging and chocking.
   vii. Gland for leakage
   viii. Cooling water flow in both the bearing housings
   ix. Condition of bearing by sound and temperature (in running condition)
   x. Performance of all measuring instruments (pressure or temperature gauges and flow meters)
   xi. Coupling Guard
   xii. Electric Motor load current
   xiii. Axial position indicator (in case of multi stage pump)
   xiv. Dowel pins (in position or not; wherever provided)

2. After 4000 running hours or 1 year whichever earlier

   i. Repeat all checks per No: 1.
   ii. Flushing of bearing with lube oil and refilling of oil to required level, whether carried out or not
   iii. Flushing of cooling water lines and strainers, whether carried out or not (to ensure proper flow of cooling water.
   iv. Foundation, foundation bolts and supports
   v. Replacement of old packing with new ones and condition of gland follower, lantern ring and sleeves (in case of gland packing)
   vi. Condition of coupling, coupling bolts, nuts, spring washers and their conformity to uniform size. Change grease in half coupling in case of gear type.

3. After 8000 hours or 2 years whichever earlier

   i. Repeat all checks per No: 2.
   ii. Condition of outboard bearing, lock nut and lock washer (in case lock washer found damaged and lock nut loose, shaft axial play shall be checked)
   iii. Following items of Journal bearings :
      a) High spot (High Spots shall be scrapped)
      b) Condition of thrust bearing, lock nut and lock washer (in case lock washer found damaged and lock nut loose, shaft axial play shall be checked).
   iv. Inspection of bearings (replace the bearings if necessary).
   v. Pump float (adjust if necessary)
   vi. Oil filter for cleanliness if journal bearings are hydrodynamic
   vii. Inspect condition of mechanical seals
   viii. Alignment (Misalignment shall not be more than 0.05 mm)
   ix. Painting of equipment, whether carried out or not
      Notes:
      i) After completing the checks listed above the pump shall be started and the following shall be checked during the trial run (the trial run duration shall be half to one hour for electric driven and 3 to 4 hours for diesel driven):
         a) Discharge pressure
         b) Suction pressure
         c) Liquid flow (if possible)
         d) Condition of mechanical seal/ gland packing
         e) Electric Motor load current at discharge valve shutoff and open condition

f) Condition of bearing by sound and temperature
g) Any leakage
h) Vibration and shock pulse reading

ii) Pumps in hot service shall not be rotated unless it is gradually heated up to a temperature close to that of the working fluid.

4. After 16000 hours or 4 years whichever earlier

Complete overhauling of the pump shall be carried out. This shall include part-wise inspection as per item 'V' and all checks specified for 8000 hours.

II. HORIZONTAL CENTRIFUGAL PUMPS (OVERHANGING TYPE)

All the following items shall be checked or recorded after the specified period

1. After 1000 hours or 3 months whichever earlier

i. Oil in bearing housing for water contamination and sediment (replace oil if necessary)
ii. Oil ring for proper working
iii. Constant level oiler for proper working
iv. Gland packing (for leakage)
v. Condition of mechanical seal
vi. Cooling water flow
vii. Condition of coupling guard
viii. Condition of bearing by sound and temperature
ix. Electric motor load current (at discharge valve shutoff and open condition)
x. Performance of all measuring instruments (pressure/ temperature gauges and flow meters)
xi. Greasing of bearing; if bearings are grease lubricated

2. After 4000 hours or 1 year whichever earlier

i. Repeat all checks per No: 1.
ii. Flushing of cooling water lines and cleaning of Strainers, whether carried out or not (to ensure proper flow of cooling water)
iii. Condition of coupling (in decoupled condition)
iv. Coupling end support for any abnormality
v. Foundation, foundation bolts and supports.

vi. Alignment (Realign, if necessary)
vii. Performance of all measuring instruments and recording of readings
viii. Suction line strainer for cleanliness

3. After 8000 hours or 2 years whichever earlier

   Complete overhauling of the pump shall be carried out. This shall include partwise inspection as per item 'V' and all checks per item 2
   Notes:
   i. After completing the checks listed above the pump shall be started and the following shall be checked during the trial run (the trial run duration shall be half to one hour for electric driven and 3 to 4 hours for diesel driven):
      a) Discharge pressure
      b) Suction pressure
      c) Liquid flow (if possible)
      d) Condition of mechanical seal / gland packing
      e) Electric motor load current at discharge valve shutoff and open condition
      f) Condition of bearing by sound and temperature
      g) Any Leakage
      h) Vibration and shock pulse reading
   ii. Pumps in hot service shall not be rotated unless it is gradually heated up to a temperature close to that of the working fluid.

III. SUBMERSIBLE PUMPS (WET MOTOR TYPE AND DRY MOTOR TYPE)

The following items shall be checked or recorded:

1. After every 250 hours or fortnightly whichever earlier
   i. Ensure optimum liquid level to avoid dry run wherever auto cut or in cut is not provided
   ii. Motor load current
   iii. Pump discharge pressure
   iv. Any abnormal sound and vibration of connected piping

2. After every 8000 hrs. or 2 years whichever earlier (for saline service, this interval may be reduced as required**)**
   Complete overhauling of the pump shall be carried out. This shall include part-wise inspection as per item 'V' – Part-Wise Inspection During Complete Overhaul of Centrifugal Pumps

IV. VERTICAL CENTRIFUGAL PUMPS

All the following items shall be checked/ recorded after the specified period:

1. After 1000 hours or 3 months whichever earlier

   i. Oil in bearing housing for water contamination and sediment (Replace oil if necessary)
   ii. Constant level oiler for proper working
   iii. Gland packing (for leakage)
   iv. Condition of mechanical seal
   v. Cooling water flow
   vi. Condition of coupling guard
   vii. Condition of bearing by sound and temperature
   viii. Electric motor load current (at discharge valve shutoff and open condition)
   ix. Performance of all measuring instruments (pressure/ temperature gauges and flow meters)

2. After 4000 hours or 1 year whichever earlier

   i. Repeat all checks per No: 1
   ii. Flushing of cooling water lines and cleaning of Strainers, whether carried out or not (to proper flow of cooling water)
   iii. Condition of coupling (in decoupled condition)
   iv. Foundation, foundation bolts and supports
   v. Alignment (realign, if necessary)
   vi. Performance of all measuring instruments and recording of readings
   vii. Suction line strainer for cleanliness

3. After every 24000 hours or 4 years whichever earlier

   Complete overhauling shall be carried out. During overhauling, part-wise, inspection as per item ‘V’ and checks specified for 4000 hours shall be carried out.