WP 2
Inventory of Existing Maintenance Technologies

The Interreg IVB North Sea Region Programme
Investing in the future by working together for a sustainable and competitive region
European Union
The European Regional Development Fund

Principles of hydraulics

Description

- Basic knowledge of hydraulics from the perspective of the maintenance technician
- Components
- Basic schemes: reading and interpretation
- Troubleshooting for installations
- Basic maintenance
- Search of spare parts

Field of application

Industrial maintenance mechanics e.g. in:

- Production manufacturing
- Elevators
- Hydraulic presses (paper industry, chipboards, etc., metal industry)
- Paper industry
- Automotive industry and handling

Material

3 Festo hydraulic trainers

Time

In use since centuries, previously on the basis of water and open systems

Scope

Very broad spectrum, especially machinery and handling

Maintenance type

Industrial maintenance mechanics

Maintenance activity

Electro-hydraulics, oil analysis

Sources

Festo, Rexroth, personal experience

Hydraulics for the advanced maintenance technician

Description

- Proportional valves
- Mounting control loops
- Open and closed systems
- Adjustment of installations
- Component knowledge
- Complex electro-hydraulic systems
- Troubleshooting
- Wear-out

Field of application

Industrial maintenance mechanics e.g. for:

- Production manufacturing
- Hydraulic presses (paper industry, chipboards, etc., metal industry)
- Paper industry
- Automotive industry and handling
- Speed control

Material

- 3 Festo hydraulic trainers
- Oscilloscope, multi-meter

Time

Developed in the 20th century (±1980)

Scope

More often used, especially in combination with electronics.

Maintenance type

Processing (adjustment technique) and production manufacturing.

Maintenance activity

Electro-hydraulic measurement

Sources

Festo/Rexroth/personal experience

Mobile hydraulics

Description of content

- Proportional valves
- Mounting control loops
- Open and closed systems
- Adjustment of installations
- Component knowledge
- Complex electro-hydraulic systems

Field of application

- Automotive industry and handling
- Speed control

Material

- 3 Festo hydraulic trainers
- Specific mounting of mobile hydraulics

Time

Developed in the 20th century (±1970)

Scope

More often used, especially in combination with electronics.

Maintenance type

Processing (adjustment technique) and production manufacturing.

Maintenance activity

Electro-hydraulic measurement

Sources

Festo/Rexroth/Sauer/personal experience

Initiation in the technique

Description

- Basic explanation
- What is a motor/reduction
- Types and function of sensors
- Basic explanation of pneumatics
- Principles of chains, bearings and belts

Field of application

In the manufacturing plant

Material

Day-to-day technical material: chains, bearings, reduction boxes, photographic cells, motors, sensors, …

Time

Not applicable

Scope

Workshop, office, outdoors, …

Maintenance type

Emergency maintenance

Maintenance activity

General

Sources

Personal experience, combined with aspects of technical modules.

Ventilators

Description of content

- Types of ventilators
- Types of screws
- Principal functions of ventilators
- Air systems
- Wear-out: recognition and problem solving
- Graphics analysis

Field of application

All types of air systems apart from air-conditioning systems.

Material

- To be purchased: trial installation ventilators
- 'Pitot' tubes
- Electronic temperature meters

Time

???

Scope

- Purifiers for polluted air (dust)
- Roof ventilators
- Air-conditioning systems
- Cooling systems

Maintenance type

Industrial mechanics

Maintenance activity

Electro-mechanical, vibration measurement, adjustment, ….

Sources

Vandommele, Lysair, Siempelkamp, Almeco, personal experience, …

Chains

Description of content

- Types of chains (new generation chains)
- Mounting
- Maintenance of chains
- Adjustment (tuning) using
    - ruler
    - measuring rod
    - laser (new)
- Wear-out

Field of application

Industrial maintenance mechanics

Material

- types of chains
- chain breakers
- laser
- trial mounting

Time

1800

Scope

Broad spectrum: for propelling forces, but also for lifting and moving.

Maintenance type

Mechanical applications

Maintenance activity

Measurement of wear-outs (new: measuring tools), detection of adjustment errors

Sources

Renold, Ketten Wulf, Mac & Coerderoi, Wipperman

Clutches

Description of content

- Types of clutches
  - Fixed clutches
  - Flexible clutches
  - Cardan joints / universal joints
- Mounting clutches
- Adjustment (tuning)
  - Basic method
  - Modern techniques
- Newest types of clutches

Field of application

Industrial maintenance mechanics

Material

- Trial lay-out
- Ruler & pocket torch
- Measuring rod
- Laser equipment

Time

???

Scope

Broad spectrum, especially driving mechanisms of pumps, mechanical chains, heavy chains, machines, …

Maintenance type

Mechanics

Maintenance activity
Detection of adjustment errors

Sources

- Allweiler
- Bowex
- Caron-Vector
- DANA/GWB
- Hansen
- Jaure
- Linopan
- Mayr
- PDC
- Ramsey
- Roloff/Matek
- Ruland
- Spidex
- Syntex
- Tschan

Bearings (basics)

Description

- Types of frequently used bearings
- Bushings
- Needle bearings
- Comprehension of numbers & suffixes
- (de-)Mounting techniques
- Detection of wear-outs
- Measurement of vibration
- Finding alternatives for bearing problems

Field of application

Industrial maintenance mechanics

Material

- Trial mounting
- Vibrometer
- Various types of bearings
- Worn-out bearings for demonstration purposes

Time

???

Scope

A rotating device contains a bearing or bushing.

Maintenance type

Mechanics

Maintenance activity

Industrial maintenance mechanics

Sources

- FAG
- Glacier
- Igus
- Imes
- INA
- NTN
- PDC
- SKF

Bearings (advanced)

Description of content

- Hydraulic (de-)mounting
- Calculation of life cycle
- Frequency and amount of greasing
- Alternatives
- Error analysis
- Troubleshooting

Field of application

Industrial maintenance mechanics

Material

- Trial lay-out
- Calculation software
- Lay-out for hydraulic mounting

Time

???

Scope

All types of machines

Maintenance type

Mechanics

Maintenance activity

Industrial maintenance mechanics and design

Sources

- FAG
- Glacier
- Igus
- Imes
- INA
- NTN
- PDC
- SKF

Flanges

Description
- Types of flanges
- Types of seals
- Tools
- Procedures
- (de-)Mounting techniques

Field of application
Industrial maintenance mechanics, piping for chemical industry, process techniques, heating systems, …

Material
- Trial lay-out
- Flanges
- Seals
- Wrench
- Stud-bolts
- PPE (Personal Protective Equipment)

Time
???

Scope
Piping

Maintenance type
Mechanics

Maintenance activity
Opening and closing flanges safely and correctly

Sources
- Proviron

Pneumatics

Description of content

- Initiation of air pressure
- Fundamental rules
- Types of cylinders and valves
- Speed control
- Interpretation and design of schemes
- Troubleshooting

Field of application

- Industrial environment

Material

- 3 pneumatics trainers

Time

???

Scope

Linear movements with low force.

Maintenance type

Electro-mechanics

Maintenance activity

Automation

Sources

- Festo
- Norgren

Pumps (basics)

Description of content

- Types of pumps
- Types of fans
- Seals
- Cavitation
- Greasing
- Minor problems related to pumps

Field of application

Processes and manufacturing

Material

- 8 trial mountings
- Defective pumps

Time

???

Scope

Broad spectrum: pouring and administering doses to fluids in production, heating and cooling fluids, discharging polluted fluids, etc…

Maintenance type

Mechanics/electricity

Maintenance activity

Measurement of wear-outs, detection of adjustment errors, pressure measurement, …

Sources

Pumps (advanced)

Description

- Pressure produced by a pump
- Dynamic/kinematic viscosity
- Turbulent and laminar flows + Reynolds number
- Principals of various pumps and areas of application
- Interpretation of graphics
- Characteristics of cabling
- Power and yield
- Parallel and serial circuits
- NPSH (Net Positive Suction Head) & cavitation
- Connection of wiring

Field of application

Processes and manufacturing

Material

- 8 trial mountings
- Defective pumps

Time

???

Scope

Broad spectrum: pouring and administering doses to fluids in production, heating and cooling fluids, discharging polluted fluids, etc…

Maintenance type

Mechanics

Maintenance activity

Measurement of wear-outs, detection of adjustment errors, pressure measurement, …

Sources

Reductions

Description

- Types of cogs
- Measurement of modules
- Types of reductions
- Methods
- Measurement/calculation of gear ratio
- Profile shifting
- Wear-out

Field of application

Industrial maintenance mechanics

Material

- Trial mounting
- Vibration and temperature measurement

Time

???

Scope

Broad spectrum: propulsions, rotating pumps, …

Maintenance type

Mechanics

Maintenance activity

Visual inspection, vibration and temperature measurement, oil analysis,…

Sources

- Cyclo
- Defawes
- Hansen
- Lenze
- SEW

Conveyor belts (basics)

Description

- Flat belts
  - Applications
  - Composition
  - Joints
  - Parts of a transmission belt
  - Transmission
  - How to install a belt correctly
  - Steering conveyor belts
  - Belt progress
  - Maintenance
- Toothed belts
  - Types and composition
  - Steering toothed belts
  - Installing toothed belts: adjustment and tightening
- V-belts
  - Types and composition
  - Installing V-belts: adjustment and tightening
  - Wear-out
  - Areas of application
  - Frequent problems with V-belts

Field of application

Industrial maintenance mechanics, area of propulsions

Material
- Trial mounting
- Measuring equipment for tightening

Time
???

Scope
Broad spectrum, especially propulsions

Maintenance type
Mechanics

Maintenance activity
- Manual measurement
- Electronic vibro-meter to measure tightness

Sources
- Habasit
- Optibelt
- PDC
- Siegling

Applied physics

Description of content

- Power, moment, leverage
- Characteristics bolts and nuts
- Types of threads
- Use of wrench
- Securing bolts and nuts
- Practical weight calculation + elementary lifting techniques

Field of application

Industrial maintenance mechanics

Material

- Trial mounting
- Wrench
- All types of bolts and nuts

Time

???

Scope

Fixing objects with the possibility of demounting at any time.

Maintenance type

Mechanics

Maintenance activity

- Use of wrenches
- Measurement of bolt extension (future)

Sources

Maintenance mechanics (basics)

Description

- Bearings
- Applied physics
- Chains
- Clutches
- Reductions
- Reading drafts
- Conveyor belts

Field of application

Industrial maintenance mechanics

Material

- Trial mounting
- Didactic material

Time

???

Scope

Broad spectrum

Maintenance type

Mechanics

Maintenance activity

Cf. respective modules

Sources

Maintenance mechanics (advanced)

Description of content

- Calculation of power of conveyor belts
- Product life cycle for bearings
- Establishing a greasing schedule
- Types of maintenance
- Vibrations

Field of application

Industrial maintenance mechanics

Material

- Calculation software
- Internet
- Vibro-meters

Time

Scope

Broad spectrum

Maintenance type

Mechanics

Maintenance activity

Cf. respective modules

Sources

Consortium

Description

- Mechanical:
  - Bearings
  - Applied physics
  - Chains
  - Clutches
  - Reductions
  - Reading drafts
  - Conveyor belts
- Electrical
  - Basics of electricity
  - Motors
  - Sensors
  - Circuits
- Pneumatic
  - Basic components + functions
  - Reading and establishing circuits
  - Detecting errors
- Safety

Field of application

Industry in general

Material

- Trial mounting
- Didactic material

Time

???

Scope

Broad spectrum

Maintenance type
Mechanics/electricity and pneumatics

Maintenance activity
Cf. respective modules

Sources

To do

- **Safety trainings (VCA, BA4-BA5, lifting,…)**
- **Links to ELC**
- **Links to “garage”**