The ontology called "Information for Prognostic and Health Management (PHM)" needs data from the Fault Diagnosis and Data Collection techniques, which interact in conjunction with Manufacturing Items, specifically with rotating mechanical Components, (according studies are the most likely to fail). In this work, the hierarchy of Manufacturing Items is considered through a bottom-up approach: Component, Machine and Equipment.

# To begin this study, data and information related queries are performed to identify: the component hierarchy, required functions, identification nomenclature, item specifications, and other information to ensure the correct identification of the component being analyzed.

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

PREFIX owl: <http://www.w3.org/2002/07/owl#>

PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

PREFIX utfpr: <http://www.semanticweb.org/david/ontologies/2016/untitled-ontology-286#>

## What are the main rotating mechanical components (Component) of a given mechanical machine? (In alphabetical order)

SELECT ?Component

WHERE {?Component rdfs:subClassOf utfpr:Component }

ORDER BY ?Component

|  |
| --- |
| **Component** |
| utfpr:Bearing |
| utfpr:Component |
| utfpr:Coupling |
| utfpr:GlandPacking |
| utfpr:Impeller |
| utfpr:JournalBearing |
| utfpr:Lubricant |
| utfpr:MechanicalSeal |
| utfpr:RollingBearing |
| utfpr:Seals |
| utfpr:Shaft |

## Considering that the intance to be analyzed is Component\_1, having a given ID, e.g., "6306\_C3". What is the Component\_1 to be analysed?

SELECT ?Component

WHERE {?Component utfpr:hasID "6306\_C3"^^xsd:string }

**OTHER WAY:**

SELECT ?Component

WHERE {?Component utfpr:hasID "6306\_C3" }

**OTHER WAY:**

SELECT ?Component

WHERE {?Component utfpr:hasID ?valor

FILTER (?valor="6306\_C3") }

|  |
| --- |
| **Component** |
| RollingBearing\_1 |

## Which Machine\_1 does the Component\_1 belong to?

SELECT ?Component ?OfMachine

WHERE {?Component utfpr:hasID "6306\_C3";

utfpr:isPartOf ?OfMachine }

|  |  |
| --- | --- |
| **Component** | **OfMachine** |
| utfpr:RollingBearing\_1 | utfpr:Pump\_1 |

## What is the specification of Machine\_1?

SELECT ?Component ?OfMachine ?TypeOfPump

WHERE {?Component utfpr:hasID "6306\_C3";

utfpr:isPartOf ?OfMachine.

?OfMachine utfpr:hasSpecification ?TypeOfPump }

|  |  |  |
| --- | --- | --- |
| **Component** | **OfMachine** | **TypeOfPump** |
| utfpr:RollingBearing\_1 | utfpr:Pump\_1 | Is a Centrifugal Pump ^^xsd:string |

## Which Equipment\_1 does the Component\_1 Machine\_1 belong to?

SELECT ?Component ?OfMachine ?TypeOfPump ?OfEquipment

WHERE {?Component utfpr:hasID "6306\_C3";

utfpr:isPartOf ?OfMachine.

?OfMachine utfpr:hasSpecification ?TypeOfPump;

utfpr:isPartOf ?OfEquipment}

|  |  |  |  |
| --- | --- | --- | --- |
| **Component** | **OfMachine** | **TypeOfPump** | **OfEquipment** |
| utfpr:RollingBearing\_1 | utfpr:CentrifugalPump\_1 | Is a Centrifugal Pump ^^xsd:string | utfpr:MachineWithSeparateDriver\_1 |

## What is the specification of Equipment\_1?

SELECT ?Component ?OfMachine ?TypeOfPump ?OfEquipment ?TypeOfEquipment

WHERE {?Component utfpr:hasID "6306\_C3";

utfpr:isPartOf ?OfMachine.

?OfMachine utfpr:hasSpecification ?TypeOfPump;

utfpr:isPartOf ?OfEquipment.

?OfEquipment utfpr:hasSpecificatio ?TypeOfEquipment }

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Component** | **OfMachine** | **TypeOfPump** | **OfEquipment** | **TypeOfEquipment** |
| utfpr:RollingBearing\_1 | utfpr:Pump\_1 | Is a Centrifufal Pump^^xsd:string | utfpr:MachineWithSeparateDriver\_1 | Is a centrifugal pump for water supplies, with separate driver^^xsd:string |

## What is Machine\_1 ID?

SELECT ?Component ?OfMachine ?MachineID

WHERE {?Component utfpr:hasID "6306\_C3";

utfpr:isPartOf ?OfMachine.

?OfMachine utfpr:hasID ?MachineID}

|  |  |  |
| --- | --- | --- |
| **Component** | **OfMachine** | **MachineID** |
| utfpr:RollingBearing\_1 | utfpr:Pump\_1 | BOM0225^^xsd:string |

## What is Equipment\_1 ID?

SELECT ?Component ?OfMachine ?MachineID ?OfEquipment ?EquipmentID

WHERE {?Component utfpr:hasID "6306\_C3";

utfpr:isPartOf ?OfMachine.

?OfMachine utfpr:hasID ?MachineID;

utfpr:isPartOf ?OfEquipment.

?OfEquipment utfpr:hasID ?EquipmentID }

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Component** | **OfMachine** | **MachineID** | **OfEquipment** | **EquipmentID** |
| utfpr:RollingBearing\_1 | utfpr:Pump\_1 | BOM0225^^xsd:string | utfpr:MachineWithSeparateDriver\_1 | ES240BOM0225^^xsd:string |

## What is the Required Function of Equipment\_1?

SELECT ?Equipment ?EquipmentFunction

WHERE { ?Equipment utfpr:hasID "ES240BOM0225";

utfpr:hasFunction ?EquipmentFunction }

|  |  |
| --- | --- |
| **Equipment** | **EquipmentFunction** |
| utfpr:MachineWithSeparateDriver\_1 | Water treatment in a given sector of a particular company^^xsd:string |

## What is the Required Function of Machine\_1?

SELECT ?Machine ?MachineFunction

WHERE { ?Machine utfpr:hasID "BOM0225";

utfpr:hasFunction ?MachineFunction }

|  |  |
| --- | --- |
| **Machine** | **MachineFunction** |
| utfpr:Pump\_1 | Water transport from A to B, at a given flow rate, in m^3/h^^xsd:string |

## What is the Required Function of Component\_1?

SELECT ?Component ?ComponentFunction

WHERE {?Component utfpr:hasID "6306\_C3";

utfpr:hasFunction ?ComponentFunction }

|  |  |
| --- | --- |
| **Component** | **ComponentFunction** |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string |

## What are the required functions of: Component\_1, Machine\_1 and Equipment\_1?

SELECT ?Component ?ComponentFunction ?Machine ?MachineFunction ?Equipment ?EquipmentFunction

WHERE {?Component utfpr:hasID "6306\_C3"^^xsd:string;

utfpr:hasFunction ?ComponentFunction;

utfpr:isPartOf ?Machine.

?Machine utfpr:hasFunction ?MachineFunction;

utfpr:isPartOf ?Equipment.

?Equipment utfpr:hasFunction ?EquipmentFunction }

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Component** | **ComponentFunction** | **Machine** | **MachineFunction** | **Equipment** | **EquipmentFunction** |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Pump\_1 | Water transport from A to B, at a given flow rate, in m^3/h^^xsd:string | utfpr:MachineWithSeparateDriver\_1 | Water treatment in a given sector of a particular company^^xsd:string |

## What are the Machines that make up the Equipment\_1?

SELECT ?EquipmentMachine

WHERE { ?EquipmentMachine utfpr:isPartOf utfpr:MachineWithSeparateDriver\_1 }

|  |
| --- |
| **EquipmentMachine** |
| CentrifugalPump\_1 |
| ElectricMotor\_1 |

## What is the required function of Machine\_1, its ID and which Equipment does it belong to?

SELECT ?Required\_Function ?ID ?Belonging\_to

WHERE { utfpr:Pump\_1 utfpr:hasFunction ?Required\_Function;

utfpr:hasID ?ID;

utfpr:isPartOf ?Belonging\_to}

|  |  |  |
| --- | --- | --- |
| **Required\_Function** | **ID** | **Belonging\_to** |
| Water transport from A to B, at a given flow rate, in m^3/h^^xsd:string | BOM0225^^xsd:string | utfpr:MachineWithSeparateDriver\_1 |

## What are the main Rotating Components of Macnhine\_1, which can be monitored?

SELECT ?Components

WHERE {?Components utfpr:isPartOf utfpr:Pump\_1}

ORDER BY ?Components

|  |
| --- |
| **Components** |
| RollingBearing\_1 |
| Coupling\_1 |
| Impeller\_1 |
| Lubricant\_1 |
| MechanicalSeal\_1 |
| Shaft\_1 |

## What is the required function, ID, and which Machine belongs the Component\_1?

SELECT ?Required\_Function ?ID ?Belonging\_to

WHERE { utfpr:RollingBearing\_1 utfpr:hasFunction ?Required\_Function;

utfpr:hasID ?ID;

utfpr:isPartOf ?Belonging\_to}

|  |  |  |
| --- | --- | --- |
| **Required\_Function** | **ID** | **Belonging\_to** |
| Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | 6306\_C3^^xsd:string | utfpr:Pump\_1 |

## Finally, to identify the mechanical item to be analyzed and start with FMSA, we need to know.

## What are the main features of the Component\_1?

SELECT ?Component ?ComponentID ?TypeOfComponent ?OfMachine ?ComponentFunction

WHERE {?Component utfpr:hasID "6306\_C3";

utfpr:hasID ?ComponentID;

utfpr:hasSpecification ?TypeOfComponent;

utfpr:isPartOf ?OfMachine;

utfpr:hasFunction ?ComponentFunction }

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Component** | **ComponentID** | **TypeOfComponent** | **Ofmachine** | **ComponentFunction** |
| utfpr:RollingBearing\_1 | 6306\_C3^^xsd:string | Single row deep groove ball bearings^^xsd:string | utfpr:Pump\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string |

# Identified of Component\_1 and mainly its Required Function for the Machine / Equipment, is now carried out the Fault Diagnosis of said Component\_1 (RollingBearing\_1) using the Failure Mode Symptoms Analysis (FMSA) technique. Thus, the following queries are performed from the Fault Diagnostics, which is a kind of database, collected from interviews, technical and scientifics bibliographic references and historical of real systems.

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

PREFIX owl: <http://www.w3.org/2002/07/owl#>

PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

PREFIX utfpr: <http://www.semanticweb.org/david/ontologies/2016/untitled-ontology-286#>

## What are the Component\_1 Failure Modes?

SELECT ?Component ?RequiredFunction ?FailureMode

WHERE {?Component utfpr:hasID "6306\_C3";

utfpr:hasFunction ?RequiredFunction

utfpr:hasMode ?FailureMode}

|  |  |  |
| --- | --- | --- |
| **Component** | **RequiredFunction** | **FailureMode** |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Deformation\_1 |

## What are the Potential Cause of each Failure Mode identified in the Component\_1?

SELECT ?Component ?RequiredFunction ?FailureMode ?PotencialCause ?IsCausedBy

WHERE {?Component utfpr:hasID "6306\_C3";

utfpr:hasFunction ?RequiredFunction;

utfpr:hasMode ?FailureMode.

?FailureMode utfpr:hasCause ?PotencialCause.

?PotencialCause utfpr:isCausedBy ?IsCausedBy }

ORDER BY ?FailureMode

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Component** | **RequiredFunction** | **FailureMode** | **PotencialCause** | **IsCausedBy** |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Deformation\_1 | utfpr:PotencialCause\_14 | Angular misalignment of shaft due to mounting incorrect^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Deformation\_1 | utfpr:PotencialCause\_15 | Parallel misalignment of shaft due to mounting incorrect^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | utfpr:PotencialCause\_19 | Ductile crack due to interference fit above of specified^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | utfpr:PotencialCause\_20 | Ductile crack due to lack of free side for dilation^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | utfpr:PotencialCause\_21 | Fatigue due to fastening bolt loose^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | utfpr:PotencialCause\_17 | Fatigue in bearing parts by mounting with high pressure between housing and bearing/shaft^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | utfpr:PotencialCause\_18 | Ductile crack due to excessive tightening on the sides of the bearing^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | utfpr:PotencialCause\_16 | Fatigue in rolling bearing parts by housing misalignment^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | utfpr:PotencialCause\_13 | Bolt specification with lower yield strength than required^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | utfpr:PotencialCause\_11 | Loose bearing due to fracture in thread of bolt^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | utfpr:PotencialCause\_12 | Incorrect tightening due to lack of tools^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | utfpr:PotencialCause\_7 | Fretting wear due to excessive amount of lubricant (swirling)^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | utfpr:PotencialCause\_6 | Fretting wear due to poor sealing that contaminates the lubricant (forming blistering)^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | utfpr:PotencialCause\_9 | Wear of parts due to poor sealing that contaminates the lubricant with abrasive particles^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | utfpr:PotencialCause\_8 | Wear due to lack of tightening of parts (looseness)^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | utfpr:PotencialCause\_3 | Adhesive wear due to low lubricant level^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | utfpr:PotencialCause\_2 | Adhesive wear due to incorrect lubricant specification^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | utfpr:PotencialCause\_10 | Pitting corrosion due to contamination of the lubricant^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | utfpr:PotencialCause\_5 | Fretting wear due to vibration of bearing housing^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | utfpr:PotencialCause\_4 | Fretting wear due to lack tightening on the bearing sides (looseness)^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | utfpr:PotencialCause\_1 | Adhesive wear due to load above projected capacity^^xsd:string |

**OTHER WAY:**

SELECT ?Component ?RequiredFunction ?FailureMode ?IsCausedBy

WHERE {?Component utfpr:hasID "6306\_C3";

utfpr:hasFunction ?RequiredFunction;

utfpr:hasMode ?FailureMode.

?FailureMode utfpr:hasCause ?PotencialCause.

?PotencialCause utfpr:isCausedBy ?IsCausedBy }

ORDER BY ?FailureMode

|  |  |  |  |
| --- | --- | --- | --- |
| **Component** | **RequiredFunction** | **FailureMode** | **IsCausedBy** |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Deformation\_1 | Angular misalignment of shaft due to mounting incorrect^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Deformation\_1 | Parallel misalignment of shaft due to mounting incorrect^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Ductile crack due to interference fit above of specified^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Ductile crack due to lack of free side for dilation^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Fatigue due to fastening bolt loose^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Fatigue in bearing parts by mounting with high pressure between housing and bearing/shaft^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Ductile crack due to excessive tightening on the sides of the bearing^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Fatigue in rolling bearing parts by housing misalignment^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Bolt specification with lower yield strength than required^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Loose bearing due to fracture in thread of bolt^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Incorrect tightening due to lack of tools^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to excessive amount of lubricant (swirling)^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to poor sealing that contaminates the lubricant (forming blistering)^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Wear of parts due to poor sealing that contaminates the lubricant with abrasive particles^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Wear due to lack of tightening of parts (looseness)^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Adhesive wear due to low lubricant level^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Adhesive wear due to incorrect lubricant specification^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Pitting corrosion due to contamination of the lubricant^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to vibration of bearing housing^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to lack tightening on the bearing sides (looseness)^^xsd:string |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Adhesive wear due to load above projected capacity^^xsd:string |

**OTHER WAY:**

SELECT ?TypeOfComponent ?RequiredFunction ?FailureMode ?IsCausedBy

WHERE {?Component utfpr:hasID "6306\_C3";

utfpr:hasSpecification ?TypeOfComponent;

utfpr:hasFunction ?RequiredFunction;

utfpr:hasMode ?FailureMode.

?FailureMode utfpr:hasCause ?PotencialCause.

?PotencialCause utfpr:isCausedBy ?IsCausedBy }

ORDER BY ?FailureMode

|  |  |  |  |
| --- | --- | --- | --- |
| **TypeOfComponent** | **RequiredFunction** | **FailureMode** | **IsCausedBy** |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Deformation\_1 | Angular misalignment of shaft due to mounting incorrect^^xsd:string |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Deformation\_1 | Parallel misalignment of shaft due to mounting incorrect^^xsd:string |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Ductile crack due to interference fit above of specified^^xsd:string |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Ductile crack due to lack of free side for dilation^^xsd:string |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Fatigue due to fastening bolt loose^^xsd:string |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Fatigue in bearing parts by mounting with high pressure between housing and bearing/shaft^^xsd:string |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Ductile crack due to excessive tightening on the sides of the bearing^^xsd:string |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Fatigue in rolling bearing parts by housing misalignment^^xsd:string |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Bolt specification with lower yield strength than required^^xsd:string |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Loose bearing due to fracture in thread of bolt^^xsd:string |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Incorrect tightening due to lack of tools^^xsd:string |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to excessive amount of lubricant (swirling)^^xsd:string |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to poor sealing that contaminates the lubricant (forming blistering)^^xsd:string |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Wear of parts due to poor sealing that contaminates the lubricant with abrasive particles^^xsd:string |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Wear due to lack of tightening of parts (looseness)^^xsd:string |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Adhesive wear due to low lubricant level^^xsd:string |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Adhesive wear due to incorrect lubricant specification^^xsd:string |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Pitting corrosion due to contamination of the lubricant^^xsd:string |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to vibration of bearing housing^^xsd:string |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to lack tightening on the bearing sides (looseness)^^xsd:string |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Adhesive wear due to load above projected capacity^^xsd:string |

## What are the Effects of Component\_1 Failure Mode?

SELECT ?Component ?Failure ?Cause ?Effect

WHERE {?Component utfpr:hasCode "6306\_C3"xsd:string;

utfpr:hasMode ?Failure.

?Failure utfpr:hasCause ?Cause;

utfpr:hasEffect ?Effect}

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **TypeOfComponent** | **RequiredFunction** | **FailureMode** | **IsCausesBy** | **Effect** |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Deformation\_1 | Angular misalignment of shaft due to mounting incorrect^^xsd:string | utfpr:Overheat\_1 |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Deformation\_1 | Parallel misalignment of shaft due to mounting incorrect^^xsd:string | utfpr:Overheat\_1 |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Ductile crack due to interference fit above of specified^^xsd:string | utfpr:OperationImpaired\_1 |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Ductile crack due to lack of free side for dilation^^xsd:string | utfpr:OperationImpaired\_1 |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Fatigue due to fastening bolt loose^^xsd:string | utfpr:OperationImpaired\_1 |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Fatigue in bearing parts by mounting with high pressure between housing and bearing/shaft^^xsd:string | utfpr:OperationImpaired\_1 |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Ductile crack due to excessive tightening on the sides of the bearing^^xsd:string | utfpr:OperationImpaired\_1 |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Fatigue in rolling bearing parts by housing misalignment^^xsd:string | utfpr:OperationImpaired\_1 |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Bolt specification with lower yield strength than required^^xsd:string | utfpr:Sound\_1 |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Loose bearing due to fracture in thread of bolt^^xsd:string | utfpr:Sound\_1 |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Incorrect tightening due to lack of tools^^xsd:string | utfpr:Sound\_1 |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to excessive amount of lubricant (swirling)^^xsd:string | utfpr:Sound\_1 |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to poor sealing that contaminates the lubricant (forming blistering)^^xsd:string | utfpr:Sound\_1 |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Wear of parts due to poor sealing that contaminates the lubricant with abrasive particles^^xsd:string | utfpr:Sound\_1 |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Wear due to lack of tightening of parts (looseness)^^xsd:string | utfpr:Sound\_1 |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Adhesive wear due to low lubricant level^^xsd:string | utfpr:Sound\_1 |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Adhesive wear due to incorrect lubricant specification^^xsd:string | utfpr:Sound\_1 |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Pitting corrosion due to contamination of the lubricant^^xsd:string | utfpr:Sound\_1 |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to vibration of bearing housing^^xsd:string | utfpr:Sound\_1 |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to lack tightening on the bearing sides (looseness)^^xsd:string | utfpr:Sound\_1 |
| Single row deep groove ball bearings^^xsd:string | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Adhesive wear due to load above projected capacity^^xsd:string | utfpr:Sound\_1 |

## What is the severity (SEV) of each Effect of Component\_1, on a given production process?

SELECT ?Component ?Failure ?Cause ?Effect ?SEV

WHERE {?Component utfpr:hasCode "6306\_C3"xsd:string;

utfpr:hasMode ?Failure.

?Failure utfpr:hasCause ?Cause;

utfpr:hasEffect ?Effect.

?Effect utfpr:hasSEV ?SEV }

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Component** | **FailureMode** | **IsCausedBy** | **Effect** | **SEV** |
| utfpr:RollingBearing\_1 | utfpr:Wear\_1 | Bolt specification with lower yield strength than required^^xsd:string | utfpr:Sound\_1 | 2 |
| utfpr:RollingBearing\_1 | utfpr:Wear\_1 | Loose bearing due to fracture in thread of bolt^^xsd:string | utfpr:Sound\_1 | 2 |
| utfpr:RollingBearing\_1 | utfpr:Wear\_1 | Incorrect tightening due to lack of tools^^xsd:string | utfpr:Sound\_1 | 2 |
| utfpr:RollingBearing\_1 | utfpr:Wear\_1 | Fretting wear due to excessive amount of lubricant (swirling)^^xsd:string | utfpr:Sound\_1 | 2 |
| utfpr:RollingBearing\_1 | utfpr:Wear\_1 | Fretting wear due to poor sealing that contaminates the lubricant (forming blistering)^^xsd:string | utfpr:Sound\_1 | 2 |
| utfpr:RollingBearing\_1 | utfpr:Wear\_1 | Wear of parts due to poor sealing that contaminates the lubricant with abrasive particles^^xsd:string | utfpr:Sound\_1 | 2 |
| utfpr:RollingBearing\_1 | utfpr:Wear\_1 | Wear due to lack of tightening of parts (looseness)^^xsd:string | utfpr:Sound\_1 | 2 |
| utfpr:RollingBearing\_1 | utfpr:Wear\_1 | Adhesive wear due to low lubricant level^^xsd:string | utfpr:Sound\_1 | 2 |
| utfpr:RollingBearing\_1 | utfpr:Wear\_1 | Adhesive wear due to incorrect lubricant specification^^xsd:string | utfpr:Sound\_1 | 2 |
| utfpr:RollingBearing\_1 | utfpr:Wear\_1 | Pitting corrosion due to contamination of the lubricant^^xsd:string | utfpr:Sound\_1 | 2 |
| utfpr:RollingBearing\_1 | utfpr:Wear\_1 | Fretting wear due to vibration of bearing housing^^xsd:string | utfpr:Sound\_1 | 2 |
| utfpr:RollingBearing\_1 | utfpr:Wear\_1 | Fretting wear due to lack tightening on the bearing sides (looseness)^^xsd:string | utfpr:Sound\_1 | 2 |
| utfpr:RollingBearing\_1 | utfpr:Wear\_1 | Adhesive wear due to load above projected capacity^^xsd:string | utfpr:Sound\_1 | 2 |
| utfpr:RollingBearing\_1 | utfpr:Deformation\_1 | Angular misalignment of shaft due to mounting incorrect^^xsd:string | utfpr:Overheat\_1 | 3 |
| utfpr:RollingBearing\_1 | utfpr:Deformation\_1 | Parallel misalignment of shaft due to mounting incorrect^^xsd:string | utfpr:Overheat\_1 | 3 |
| utfpr:RollingBearing\_1 | utfpr:Fracture\_1 | Ductile crack due to interference fit above of specified^^xsd:string | utfpr:OperationImpaired\_1 | 4 |
| utfpr:RollingBearing\_1 | utfpr:Fracture\_1 | Ductile crack due to lack of free side for dilation^^xsd:string | utfpr:OperationImpaired\_1 | 4 |
| utfpr:RollingBearing\_1 | utfpr:Fracture\_1 | Fatigue due to fastening bolt loose^^xsd:string | utfpr:OperationImpaired\_1 | 4 |
| utfpr:RollingBearing\_1 | utfpr:Fracture\_1 | Fatigue in bearing parts by mounting with high pressure between housing and bearing/shaft^^xsd:string | utfpr:OperationImpaired\_1 | 4 |
| utfpr:RollingBearing\_1 | utfpr:Fracture\_1 | Ductile crack due to excessive tightening on the sides of the bearing^^xsd:string | utfpr:OperationImpaired\_1 | 4 |
| utfpr:RollingBearing\_1 | utfpr:Fracture\_1 | Fatigue in rolling bearing parts by housing misalignment^^xsd:string | utfpr:OperationImpaired\_1 | 4 |

## What are the Symptoms of each Potential Cause of Component 1?

SELECT ?Component ?ComponentFunction ?FailureMode ?IsCausedBy ?Symptom

WHERE {?Component utfpr:hasID "6306\_C3";

utfpr:hasFunction ?ComponentFunction;

utfpr:hasMode ?FailureMode.

?FailureMode utfpr:hasCause ?PotencialCause.

?PotencialCause utfpr:isCausedBy ?IsCausedBy;

utfpr:hasSymptom ?Symptom }

ORDER BY ?FailureMode

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Component** | **ComponentFunction** | **FailureMode** | **IsCausedBy** | **Symptom** |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Deformation\_1 | Angular misalignment of shaft due to mounting incorrect^^xsd:string | utfpr:Vibration\_10 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Deformation\_1 | Parallel misalignment of shaft due to mounting incorrect^^xsd:string | utfpr:Vibration\_11 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Ductile crack due to interference fit above of specified^^xsd:string | utfpr:Temperature\_3 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Ductile crack due to lack of free side for dilation^^xsd:string | utfpr:Temperature\_4 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Fatigue due to fastening bolt loose^^xsd:string | utfpr:Vibration\_15 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Fatigue in bearing parts by mounting with high pressure between housing and bearing/shaft^^xsd:string | utfpr:Temperature\_2 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Fatigue in bearing parts by mounting with high pressure between housing and bearing/shaft^^xsd:string | utfpr:Vibration\_13 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Ductile crack due to excessive tightening on the sides of the bearing^^xsd:string | utfpr:Vibration\_14 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Fatigue in rolling bearing parts by housing misalignment^^xsd:string | utfpr:Vibration\_12 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Bolt specification with lower yield strength than required^^xsd:string | utfpr:Vibration\_9 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Loose bearing due to fracture in thread of bolt^^xsd:string | utfpr:Vibration\_7 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Incorrect tightening due to lack of tools^^xsd:string | utfpr:Vibration\_8 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to excessive amount of lubricant (swirling)^^xsd:string | utfpr:Vibration\_4 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to poor sealing that contaminates the lubricant (forming blistering)^^xsd:string | utfpr:LubricantProperty\_2 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Wear of parts due to poor sealing that contaminates the lubricant with abrasive particles^^xsd:string | utfpr:LubricantProperty\_3 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Wear due to lack of tightening of parts (looseness)^^xsd:string | utfpr:Vibration\_5 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Adhesive wear due to low lubricant level^^xsd:string | utfpr:Temperature\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Adhesive wear due to incorrect lubricant specification^^xsd:string | utfpr:LubricantProperty\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Pitting corrosion due to contamination of the lubricant^^xsd:string | utfpr:Vibration\_6 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to vibration of bearing housing^^xsd:string | utfpr:Vibration\_3 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to lack tightening on the bearing sides (looseness)^^xsd:string | utfpr:Vibration\_2 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Adhesive wear due to load above projected capacity^^xsd:string | utfpr:Vibration\_1 |

## What is the weight (DGN) of each symptom to assist in the elaboration of a effective Diagnostics of Component\_1?

SELECT ?Component ?ComponentFunction ?FailureMode ?IsCausedBy ?Symptom ?DGN

WHERE {?Component utfpr:hasID "6306\_C3";

utfpr:hasFunction ?ComponentFunction;

utfpr:hasMode ?FailureMode.

?FailureMode utfpr:hasCause ?PotencialCause.

?PotencialCause utfpr:isCausedBy ?IsCausedBy;

utfpr:hasSymptom ?Symptom.

?Symptom utfpr:hasDGN ?DGN }

ORDER BY ?FailureMode

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Component** | **ComponentFunction** | **FailureMode** | **IsCausedBy** | **Symptom** | **DGN** |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Deformation\_1 | Angular misalignment of shaft due to mounting incorrect^^xsd:string | utfpr:Vibration\_10 | 3 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Deformation\_1 | Parallel misalignment of shaft due to mounting incorrect^^xsd:string | utfpr:Vibration\_11 | 3 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Ductile crack due to interference fit above of specified^^xsd:string | utfpr:Temperature\_3 | 3 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Ductile crack due to lack of free side for dilation^^xsd:string | utfpr:Temperature\_4 | 3 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Fatigue due to fastening bolt loose^^xsd:string | utfpr:Vibration\_15 | 5 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Fatigue in bearing parts by mounting with high pressure between housing and bearing/shaft^^xsd:string | utfpr:Temperature\_2 | 3 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Fatigue in bearing parts by mounting with high pressure between housing and bearing/shaft^^xsd:string | utfpr:Vibration\_13 | 3 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Ductile crack due to excessive tightening on the sides of the bearing^^xsd:string | utfpr:Vibration\_14 | 3 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Fatigue in rolling bearing parts by housing misalignment^^xsd:string | utfpr:Vibration\_12 | 5 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Bolt specification with lower yield strength than required^^xsd:string | utfpr:Vibration\_9 | 3 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Loose bearing due to fracture in thread of bolt^^xsd:string | utfpr:Vibration\_7 | 5 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Incorrect tightening due to lack of tools^^xsd:string | utfpr:Vibration\_8 | 4 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to excessive amount of lubricant (swirling)^^xsd:string | utfpr:Vibration\_4 | 5 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to poor sealing that contaminates the lubricant (forming blistering)^^xsd:string | utfpr:LubricantProperty\_2 | 5 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Wear of parts due to poor sealing that contaminates the lubricant with abrasive particles^^xsd:string | utfpr:LubricantProperty\_3 | 5 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Wear due to lack of tightening of parts (looseness)^^xsd:string | utfpr:Vibration\_5 | 5 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Adhesive wear due to low lubricant level^^xsd:string | utfpr:Temperature\_1 | 3 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Adhesive wear due to incorrect lubricant specification^^xsd:string | utfpr:LubricantProperty\_1 | 5 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Pitting corrosion due to contamination of the lubricant^^xsd:string | utfpr:Vibration\_6 | 4 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to vibration of bearing housing^^xsd:string | utfpr:Vibration\_3 | 4 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to lack tightening on the bearing sides (looseness)^^xsd:string | utfpr:Vibration\_2 | 4 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Adhesive wear due to load above projected capacity^^xsd:string | utfpr:Vibration\_1 | 5 |

## According to the Symptoms found for the Component\_1, what are the most effective monitoring techniques to be employed?

SELECT ?Component ?ComponentFunction ?FailureMode ?IsCausedBy ?Symptom ?Technique

WHERE {?Component utfpr:hasID "6306\_C3";

utfpr:hasFunction ?ComponentFunction;

utfpr:hasMode ?FailureMode.

?FailureMode utfpr:hasCause ?PotencialCause.

?PotencialCause utfpr:isCausedBy ?IsCausedBy;

utfpr:hasSymptom ?Symptom.

?Symptom utfpr:isDetectedWith ?Technique }

ORDER BY ?FailureMode

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Component** | **ComponentFunction** | **FailureMode** | **IsCausedBy** | **Symptom** | **Technique** |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Deformation\_1 | Angular misalignment of shaft due to mounting incorrect^^xsd:string | utfpr:Vibration\_10 | utfpr:VibrationAnalysis\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Deformation\_1 | Parallel misalignment of shaft due to mounting incorrect^^xsd:string | utfpr:Vibration\_11 | utfpr:VibrationAnalysis\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Ductile crack due to interference fit above of specified^^xsd:string | utfpr:Temperature\_3 | utfpr:InfraredThermography |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Ductile crack due to lack of free side for dilation^^xsd:string | utfpr:Temperature\_4 | utfpr:InfraredThermography |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Fatigue due to fastening bolt loose^^xsd:string | utfpr:Vibration\_15 | utfpr:VibrationAnalysis\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Fatigue in bearing parts by mounting with high pressure between housing and bearing/shaft^^xsd:string | utfpr:Temperature\_2 | utfpr:InfraredThermography |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Fatigue in bearing parts by mounting with high pressure between housing and bearing/shaft^^xsd:string | utfpr:Vibration\_13 | utfpr:VibrationAnalysis\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Ductile crack due to excessive tightening on the sides of the bearing^^xsd:string | utfpr:Vibration\_14 | utfpr:VibrationAnalysis\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Fracture\_1 | Fatigue in rolling bearing parts by housing misalignment^^xsd:string | utfpr:Vibration\_12 | utfpr:VibrationAnalysis\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Bolt specification with lower yield strength than required^^xsd:string | utfpr:Vibration\_9 | utfpr:VibrationAnalysis\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Loose bearing due to fracture in thread of bolt^^xsd:string | utfpr:Vibration\_7 | utfpr:VibrationAnalysis\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Loose bearing due to fracture in thread of bolt^^xsd:string | utfpr:Vibration\_7 | utfpr:VisulInspection\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Incorrect tightening due to lack of tools^^xsd:string | utfpr:Vibration\_8 | utfpr:VibrationAnalysis\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to excessive amount of lubricant (swirling)^^xsd:string | utfpr:Vibration\_4 | utfpr:VibrationAnalysis\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to poor sealing that contaminates the lubricant (forming blistering)^^xsd:string | utfpr:LubricantProperty\_2 | utfpr:OilAnalysis\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Wear of parts due to poor sealing that contaminates the lubricant with abrasive particles^^xsd:string | utfpr:LubricantProperty\_3 | utfpr:OilAnalysis\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Wear due to lack of tightening of parts (looseness)^^xsd:string | utfpr:Vibration\_5 | utfpr:VibrationAnalysis\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Adhesive wear due to low lubricant level^^xsd:string | utfpr:Temperature\_1 | utfpr:InfraredThermography |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Adhesive wear due to incorrect lubricant specification^^xsd:string | utfpr:LubricantProperty\_1 | utfpr:OilAnalysis\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Pitting corrosion due to contamination of the lubricant^^xsd:string | utfpr:Vibration\_6 | utfpr:VibrationAnalysis\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to vibration of bearing housing^^xsd:string | utfpr:Vibration\_3 | utfpr:VibrationAnalysis\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Fretting wear due to lack tightening on the bearing sides (looseness)^^xsd:string | utfpr:Vibration\_2 | utfpr:VibrationAnalysis\_1 |
| utfpr:RollingBearing\_1 | Support and allows the shaft rotates without friction, at a given rpm^^xsd:string | utfpr:Wear\_1 | Adhesive wear due to load above projected capacity^^xsd:string | utfpr:Vibration\_1 | utfpr:VibrationAnalysis\_1 |

**Consulta13:** Quais são os modos de falha, causas potenciais, efeitos, sua severidade (SEV), sintomas, DGN, técnica de medição recomendada e DET para o componente **RollingBearing\_1**?

SELECT ?Component ?Failure ?Cause ?Effect ?SEV ?Symptom ?DGN ?Technique ?DET

WHERE {?Component utfpr:hasCode "6306\_C3"xsd:string;

utfpr:hasMode ?Failure.

?Failure utfpr:hasCause ?Cause;

utfpr:hasEffect ?Effect.

?Effect utfpr:hasSEV ?SEV.

?Cause utfpr:hasSymptom ?Symptom.

?Symptom utfpr:hasDGN ?DGN;

utfpr:isDetectedWith ?Technique;

utfpr:hasDET ?DET}

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Component** | **Failure** | **Cause** | **Effect** | **S**  **E**  **V** | **Symptom** | **DGN** | **Technique** | **DET** |
| RollingBearing\_1 | Fracture\_1 | 16-Fatigue\_in\_rolling\_bearing\_parts\_by\_housing\_misalignment | OperationImpaired\_1 | "4" | Vibration\_12 | "5" | VibrationAnalysis | "5" |
| RollingBearing\_1 | Fracture\_1 | 17-Fatigue\_in\_bearing\_parts\_by\_mounting\_under\_pressure\_between\_bearing\_and\_shaft | OperationImpaired\_1 | "4" | Vibration\_13 | "3" | VibrationAnalysis | "4" |
| RollingBearing\_1 | Fracture\_1 | 17-Fatigue\_in\_bearing\_parts\_by\_mounting\_under\_pressure\_between\_bearing\_and\_shaft | OperationImpaired\_1 | "4" | Temperature\_2 | "3" | InfraredThermography | "4" |
| RollingBearing\_1 | Fracture\_1 | 18-Ductile\_crack\_due\_to\_excessive\_tightening\_on\_the\_sides\_of\_the\_bearing | OperationImpaired\_1 | "4" | Vibration\_14 | "3" | VibrationAnalysis | "4" |
| RollingBearing\_1 | Fracture\_1 | 21-Fatigue\_due\_to\_fastening\_screws\_loose | OperationImpaired\_1 | "4" | Vibration\_15 | "5" | VibrationAnalysis | "5" |
| RollingBearing\_1 | Fracture\_1 | 19-Ductile\_crack\_due\_to\_interference\_fit\_above\_of\_specified | OperationImpaired\_1 | "4" | Temperature\_3 | "3" | InfraredThermography | "4" |
| RollingBearing\_1 | Fracture\_1 | 20-Ductile\_crack\_due\_to\_lack\_of\_free\_side\_for\_dilation | OperationImpaired\_1 | "4" | Temperature\_4 | "3" | InfraredThermography | "4" |
| RollingBearing\_1 | Deformation\_1 | 14-Angular\_misalignment\_of\_shaft\_due\_to\_mounting\_incorrect | Overheat\_1 | "3" | Vibration\_10 | "3" | VibrationAnalysis | "3" |
| RollingBearing\_1 | Deformation\_1 | 15-Parallel\_misalignment\_of\_shaft\_due\_to\_mounting\_incorrect | Overheat\_1 | "3" | Vibration\_11 | "3" | VibrationAnalysis | "3" |
| RollingBearing\_1 | Wear\_1 | 4-Fretting\_wear\_due\_to\_lack\_tightening\_on\_the\_bearing\_sides-looseness | Sound\_1 | "2" | Vibration\_2 | "4" | VibrationAnalysis | "4" |
| RollingBearing\_1 | Wear\_1 | 7-Fretting\_wear\_due\_to\_excessive\_amount\_of\_lubricant-swirling | Sound\_1 | "2" | Vibration\_4 | "5" | VibrationAnalysis | "4" |
| RollingBearing\_1 | Wear\_1 | 9-Wear\_of\_parts\_due\_to\_poor\_sealing\_that\_contaminates\_the\_lubricant\_with\_abrasive\_particles | Sound\_1 | "2" | LubricantProperty\_3 | "5" | OilAnalysis | "5" |
| RollingBearing\_1 | Wear\_1 | 3-Adhesive\_wear\_due\_to\_low\_lubricant\_level | Sound\_1 | "2" | Temperature\_1 | "3" | InfraredThermography | "5" |
| RollingBearing\_1 | Wear\_1 | 11-Bearing\_loose\_due\_to\_fracture\_in\_screw\_threads | Sound\_1 | "2" | Vibration\_7 | "5" | VibrationAnalysis | "5" |
| RollingBearing\_1 | Wear\_1 | 11-Bearing\_loose\_due\_to\_fracture\_in\_screw\_threads | Sound\_1 | "2" | Vibration\_7 | "5" | VisulInspection | "5" |
| RollingBearing\_1 | Wear\_1 | 2-Adhesive\_wear\_due\_to\_incorrect\_lubricant\_specification | Sound\_1 | "2" | LubricantProperty\_1 | "5" | OilAnalysis | "5" |
| RollingBearing\_1 | Wear\_1 | 6-Fretting\_wear\_due\_to\_poor\_sealing\_that\_contaminates\_the\_lubricant-forming\_blistering | Sound\_1 | "2" | LubricantProperty\_2 | "5" | OilAnalysis | "5" |
| RollingBearing\_1 | Wear\_1 | 13-Bolt\_specification\_with\_lower\_yield\_strength\_than\_required | Sound\_1 | "2" | Vibration\_9 | "3" | VibrationAnalysis | "3" |
| RollingBearing\_1 | Wear\_1 | 5-Fretting\_wear\_due\_to\_vibration\_of\_bearing\_housing | Sound\_1 | "2" | Vibration\_3 | "4" | VibrationAnalysis | "5" |
| RollingBearing\_1 | Wear\_1 | 12-Incorrect\_tightening\_due\_to\_lack\_of\_tools | Sound\_1 | "2" | Vibration\_8 | "4" | VibrationAnalysis | "3" |
| RollingBearing\_1 | Wear\_1 | 8-Wear\_due\_to\_lack\_of\_tightening\_of\_parts-looseness | Sound\_1 | "2" | Vibration\_5 | "5" | VibrationAnalysis | "3" |
| RollingBearing\_1 | Wear\_1 | 10-Pitting\_corrosion\_due\_to\_contamination\_of\_the\_lubricant | Sound\_1 | "2" | Vibration\_6 | "4" | VibrationAnalysis | "5" |
| RollingBearing\_1 | Wear\_1 | 1-Adhesive\_wear\_due\_to\_load\_above\_projected\_capacity | Sound\_1 | "2" | Vibration\_1 | "5" | VibrationAnalysis | "5" |

**Consulta 14:** Quais são os modos de falha, com SEV = 4, do componente **RollingBearing\_1**?

SELECT ?Component ?Failure ?Cause ?Effect ?SEV

WHERE {?Component utfpr:hasCode "6306\_C3"xsd:string;

utfpr:hasMode ?Failure.

?Failure utfpr:hasCause ?Cause;

utfpr:hasEffect ?Effect.

?Effect utfpr:hasSEV ?SEV;

utfpr:hasSEV "4"xsd:integer }

SELECT

?Component ?Failure ?Cause ?Effect ?SEV ?Symptom ?DGN ?Technique ?DET

WHERE {?Component utfpr:hasCode "6306\_C3"xsd:string;

utfpr:hasMode ?Failure.

?Failure utfpr:hasCause ?Cause;

utfpr:hasEffect ?Effect.

?Effect utfpr:hasSEV ?SEV.

?Cause utfpr:hasSymptom ?Symptom.

?Symptom utfpr:hasDGN ?DGN;

utfpr:isDetectedWith ?Technique;

utfpr:hasDET ?DET.

FILTER (?SEV = 4 )}

**Resultado:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Component** | **Failure** | **Cause** | **Effect** | **SEV** | **Symptom** | **DGN** | **Techniqye** | **DET** |
| RollingBearing\_1 | Fracture\_1 | 16-Fatigue\_in\_rolling\_bearing\_parts\_by\_housing\_misalignment | OperationImpaired\_1 | "4" | Vibration\_12 | "5" | VibrationAnalysis | "5" |
| RollingBearing\_1 | Fracture\_1 | 17-Fatigue\_in\_bearing\_parts\_by\_mounting\_under\_pressure\_between\_bearing\_and\_shaft | OperationImpaired\_1 | "4" | Vibration\_13 | "3" | VibrationAnalysis | "4" |
| RollingBearing\_1 | Fracture\_1 | 17-Fatigue\_in\_bearing\_parts\_by\_mounting\_under\_pressure\_between\_bearing\_and\_shaft | OperationImpaired\_1 | "4" | Temperature\_2 | "3" | InfraredThermography | "4" |
| RollingBearing\_1 | Fracture\_1 | 18-Ductile\_crack\_due\_to\_excessive\_tightening\_on\_the\_sides\_of\_the\_bearing | OperationImpaired\_1 | "4" | Vibration\_14 | "3" | VibrationAnalysis | "4" |
| RollingBearing\_1 | Fracture\_1 | 21-Fatigue\_due\_to\_fastening\_screws\_loose | OperationImpaired\_1 | "4" | Vibration\_15 | "5" | VibrationAnalysis | "5" |
| RollingBearing\_1 | Fracture\_1 | 19-Ductile\_crack\_due\_to\_interference\_fit\_above\_of\_specified | OperationImpaired\_1 | "4" | Temperature\_3 | "3" | InfraredThermography | "4" |
| RollingBearing\_1 | Fracture\_1 | 20-Ductile\_crack\_due\_to\_lack\_of\_free\_side\_for\_dilation | OperationImpaired\_1 | "4" | Temperature\_4 | "3" | InfraredThermography | "4" |

**Consulta 15:** Os modos de falha com SEV 4 e DGN 5

SELECT ?Component ?Failure ?Cause ?Effect ?SEV ?Symptom ?DGN ?Technique ?DET

WHERE {?Component utfpr:hasCode "6306\_C3"xsd:string;

utfpr:hasMode ?Failure.

?Failure utfpr:hasCause ?Cause;

utfpr:hasEffect ?Effect.

?Effect utfpr:hasSEV ?SEV.

?Cause utfpr:hasSymptom ?Symptom.

?Symptom utfpr:hasDGN ?DGN;

utfpr:isDetectedWith ?Technique;

utfpr:hasDET ?DET.

FILTER (?SEV = 4 )

FILTER (?DGN = 5 )}

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Componente** | **Failure** | **Cause** | **Effect** | **SEV** | **Symptom** | **DGN** | **Technique** | **DET** |
| RollingBearing\_1 | Fracture\_1 | 16-Fatigue\_in\_rolling\_bearing\_parts\_by\_housing\_misalignment | OperationImpaired\_1 | "4" | Vibration\_12 | "5" | VibrationAnalysis | "5" |
| RollingBearing\_1 | Fracture\_1 | 21-Fatigue\_due\_to\_fastening\_screws\_loose | OperationImpaired\_1 | "4" | Vibration\_15 | "5" | VibrationAnalysis | "5" |

SELECT DISTINCT ?tipo ?Component

WHERE {?Component utfpr:hasCode "6306\_C3"xsd:string .

?Component rdf:type ?tipo}

Ordenar de forma alfabética

SELECT DISTINCT ?Component ?modo WHERE {

?Component rdf:type utfpr:RollingBearing .

?Component utfpr:hasMode ?modo

} ORDER BY ?modo

Ordenar por SEV

SELECT DISTINCT ?Component ?Failure ?Cause ?Effect ?SEV

WHERE {?Component utfpr:hasCode "6306\_C3"xsd:string;

utfpr:hasMode ?Failure.

?Failure utfpr:hasCause ?Cause;

utfpr:hasEffect ?Effect.

?Effect utfpr:hasSEV ?SEV } ORDER BY ?SEV

Mostrar os comentários em inglês

SELECT DISTINCT ?tipo ?Component ?comentario

WHERE {?Component utfpr:hasCode "6306\_C3"xsd:string .

?Component rdf:type ?tipo .

?tipo rdfs:comment ?comentario

FILTER (langMatches(lang(?comentario), "en"))}

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

PREFIX owl: <http://www.w3.org/2002/07/owl#>

PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

PREFIX utfpr: < http://www.semanticweb.org/david/ontologies/2016/untitled-ontology-286#>

**Consulta 16**: Qual é o componente que tem o código **6306\_C3**?

SELECT ?Component

WHERE {?Component utfpr:hasCode "6306\_C3"xsd:string }

|  |
| --- |
| **Component** |
| RollingBearing\_1 |

**Consulta 17:** Com qual técnica de medição é monitorado o **componente\_1**?

SELECT ?Component ?Technique

WHERE {?Component utfpr:hasCode "6306\_C3"xsd:string;

utfpr:isMonitoringWith ?Technique }

|  |  |
| --- | --- |
| **Component** | **Technique** |
| RollingBearing\_1 | VibrationAnalysis\_1 |

**Consulta 18:** Que grandeza usa a técnica\_1?

SELECT ?Component ?Technique ?Magnitude

WHERE {?Component utfpr:hasCode "6306\_C3"xsd:string;

utfpr:isMonitoringWith ?Technique.

?Technique utfpr:useMagnitude ?Magnitude }

|  |  |  |
| --- | --- | --- |
| **Component** | **Technique** | **Magnitude** |
| RollingBearing\_1 | VibrationAnalysis\_1 | RMS\_Velocity\_1 |

**Consulta 19:** Qual é a unidade da Magnitude\_1?

SELECT ?Component ?Technique ?Magnitude ?Unit

WHERE {?Component utfpr:hasCode "6306\_C3"xsd:string;

utfpr:isMonitoringWith ?Technique.

?Technique utfpr:useMagnitude ?Magnitude.

?Magnitude utfpr:hasUnit ?Unit}

|  |  |  |  |
| --- | --- | --- | --- |
| **Component** | **Technique** | **Magnitude** | **Unit** |
| RollingBearing\_1 | VibrationAnalysis\_1 | RMS\_Velocity\_1 | "mm/s" |

**Consulta 20:** Qual tipo de coletor (transdutor) usa a técnica\_1?

SELECT ?Component ?Technique ?Magnitude ?Unit ?Transducer

WHERE {?Component utfpr:hasCode "6306\_C3"xsd:string;

utfpr:isMonitoringWith ?Technique.

?Technique utfpr:useMagnitude ?Magnitude;

utfpr:useCollector ?Transducer.

?Magnitude utfpr:hasUnit ?Unit}

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Component** | **Technique** | **Magnitude** | **Unit** | **Transducer** |
| RollingBearing\_1 | VibrationAnalysis\_1 | RMS\_Velocity\_1 | "mm/s" | Accelerometer\_1 |

**Consulta 21:** Quantas medições são feitas no componente\_1, usando a técnica\_1?

SELECT ?Component ?Technique ?Magnitude ?Unit ?Transducer ?Measurement

WHERE {?Component utfpr:hasCode "6306\_C3"xsd:string;

utfpr:isMonitoringWith ?Technique.

?Technique utfpr:useMagnitude ?Magnitude;

utfpr:useCollector ?Transducer;

utfpr:hasMeasurementPoint ?Measurement.

?Magnitude utfpr:hasUnit ?Unit}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Component** | **Technique** | **Magnitude** | **Unit** | **Transducer** | **Measurement** |
| RollingBearing\_1 | VibrationAnalysis\_1 | RMS\_Velocity\_1 | "mm/s" | Accelerometer\_1 | Measurement\_1 |
| RollingBearing\_1 | VibrationAnalysis\_1 | RMS\_Velocity\_1 | "mm/s" | Accelerometer\_1 | Measurement\_2 |
| RollingBearing\_1 | VibrationAnalysis\_1 | RMS\_Velocity\_1 | "mm/s" | Accelerometer\_1 | Measurement\_3 |

**Consulta 22:** Qual é a localização dessas medições no componente\_1?

SELECT ?Component ?Technique ?Magnitude ?Unit ?Transducer ?Measurement ?Location

WHERE {?Component utfpr:hasCode "6306\_C3"^^xsd:string;

utfpr:isMonitoringWith ?Technique;

utfpr:hasMeasurementPoint ?Measurement.

?Measurement utfpr:hasLocation ?Location.

?Technique utfpr:useMagnitude ?Magnitude;

utfpr:useCollector ?Transducer.

?Magnitude utfpr:hasUnit ?Unit }

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Component** | **Technique** | **Magnitude** | **Unit** | **Transducer** | **Measurement** | **Location** |
| RollingBearing\_1 | VibrationAnalysis\_1 | RMS\_Velocity\_1 | "mm/s" | Accelerometer\_1 | Measurement\_1 | "BOM0225\_003\_AC\_180\_R\_N" |
| RollingBearing\_1 | VibrationAnalysis\_1 | RMS\_Velocity\_1 | "mm/s" | Accelerometer\_1 | Measurement\_2 | "BOM0225\_003\_AC\_090\_R\_N" |
| RollingBearing\_1 | VibrationAnalysis\_1 | RMS\_Velocity\_1 | "mm/s" | Accelerometer\_1 | Measurement\_3 | "BOM0225\_003\_AC\_315\_A\_N" |

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

PREFIX owl: <http://www.w3.org/2002/07/owl#>

PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

PREFIX utfpr: < [http://www.semanticweb.org/david/ontologies/2016/untitled-ontology-286#](http://www.semanticweb.org/david/ontologies/2016/untitled-ontology-286)>

**Consulta 23:** Quais são os grupos para avaliar zonas de limites?

SELECT ?Groups

WHERE {

?Groups rdf:type utfpr:GroupOfMachine }

|  |
| --- |
| **Groups** |
| Group\_1 |
| Group\_2 |
| Group\_3 |
| Group\_4 |

**Consulta 24:** Quase são as características de cada grupo?

SELECT ?Groups ?Features

WHERE {

?Groups utfpr:hasFeatures ?Features }

|  |  |
| --- | --- |
| **Groups** | **Features** |
| Group\_2 | "Machines with shaft heigh 160 mm <= H < 315 mm" |
| Group\_3 | "Used in pump machine with separate driver" |
| Group\_1 | "Macines with shaft heigt H >= 315 mm" |
| Group\_4 | "Used in pump machine with integrated driver" |
| Group\_3 | "Is a pump" |
| Group\_1 | "Machines with rated power: 300 kW < P < 50 MW" |
| Group\_4 | "Is a pump" |
| Group\_3 | "Machines with rated power: P > 15kW" |
| Group\_1 | "Is an electrical machine" |
| Group\_4 | "Machines with rated power: P > 15kW" |
| Group\_2 | "Is an electrical machine" |
| Group\_2 | "Machines with rated power: 15 kw < P <= 300 kW" |

Ordenar por ordem alfabético, segundo grupo

SELECT ?Groups ?Features

WHERE {

?Groups utfpr:hasFeatures ?Features }

ORDER BY ?Groups

|  |  |
| --- | --- |
| **Groups** | **Features** |
| Group\_1 | "Macines with shaft heigt H >= 315 mm" |
| Group\_1 | "Machines with rated power: 300 kW < P < 50 MW" |
| Group\_1 | "Is an electrical machine" |
| Group\_2 | "Machines with shaft heigh 160 mm <= H < 315 mm" |
| Group\_2 | "Is an electrical machine" |
| Group\_2 | "Machines with rated power: 15 kw < P <= 300 kW" |
| Group\_3 | "Used in pump machine with separate driver" |
| Group\_3 | "Used in pump machine" |
| Group\_3 | "Machines with rated power: P > 15kW" |
| Group\_4 | "Used in pump machine with integrated driver" |
| Group\_4 | "Used in pump machine" |
| Group\_4 | "Machines with rated power: P > 15kW" |

**Consulta 25:** Qual grupo avalia zonas de limites para máquinas “bomba”?

SELECT ?Groups ?Features

WHERE { ?Groups utfpr:hasFeatures ?Features

FILTER (?Features="Used in pump machine") }

|  |  |
| --- | --- |
| **Groups** | **Features** |
| Group\_3 | "Used in pump machine" |
| Group\_4 | "Used in pump machine" |

Outra forma

SELECT ?Groups ?Features

WHERE { ?Groups utfpr:hasFeatures ?Features;

utfpr:hasFeatures "Used in pump machine"^^xsd:string }

|  |  |
| --- | --- |
| **Groups** | **Features** |
| Group\_4 | "Used in pump machine with integrated driver" |
| Group\_4 | "Machines with rated power: P > 15kW" |
| Group\_4 | "Used in pump machine" |
| Group\_3 | "Used in pump machine with separate driver" |
| Group\_3 | "Used in pump machine" |
| Group\_3 | "Machines with rated power: P > 15kW" |

Filtrando a consulta até chegar ao grupo desejado

**Consulta 25:** Grupo que atenda a máquinas “bomba” com potência > 15kW

SELECT ?Groups ?Features

WHERE { ?Groups utfpr:hasFeatures ?Features;

utfpr:hasFeatures "Used in pump machine"^^xsd:string;

utfpr:hasFeatures "Machines with rated power: P > 15kW"^^xsd:string}

|  |  |
| --- | --- |
| **Groups** | **Features** |
| Group\_4 | ""Used in pump machine with integrated driver" |
| Group\_4 | "Machines with rated power: P > 15kW" |
| Group\_4 | "Used in pump machine" |
| Group\_3 | "Used in pump machine with separate driver" |
| Group\_3 | "Used in pump machine" |
| Group\_3 | "Machines with rated power: P > 15kW" |

**Consulta 25:** Grupo que atenda a máquinas “bomba” com potência > 15kW e que o sistema de acionamento (motor) seja separado

SELECT ?Groups ?Features

WHERE { ?Groups utfpr:hasFeatures ?Features;

utfpr:hasFeatures "Used in pump machine"^^xsd:string;

utfpr:hasFeatures "Machines with rated power: P > 15kW"^^xsd:string;

utfpr:hasFeatures "Used in pump machine with separate driver"^^xsd:string}

|  |  |
| --- | --- |
| **Groups** | **Features** |
| Group\_3 | "Used in pump machine" |
| Group\_3 | "Machines with rated power: P > 15kW" |
| Group\_3 | "Used in pump machine with separate driver" |