

Reliability Dynamics

Industry Standard Solution for Plant Maintenance (ISPM®)

Tony Ciliberti PE, Founder and Principal Engineer, Reliability Dynamics

SAP® Certified
Integration with SAP S/4HANA®

The logo for ISPM Add-on for SAP is displayed on a solid orange rectangular background. The letters 'ISPM' are in a very large, bold, black sans-serif font. Below them, the text 'Add-on for SAP' is written in a smaller, bold, black sans-serif font.

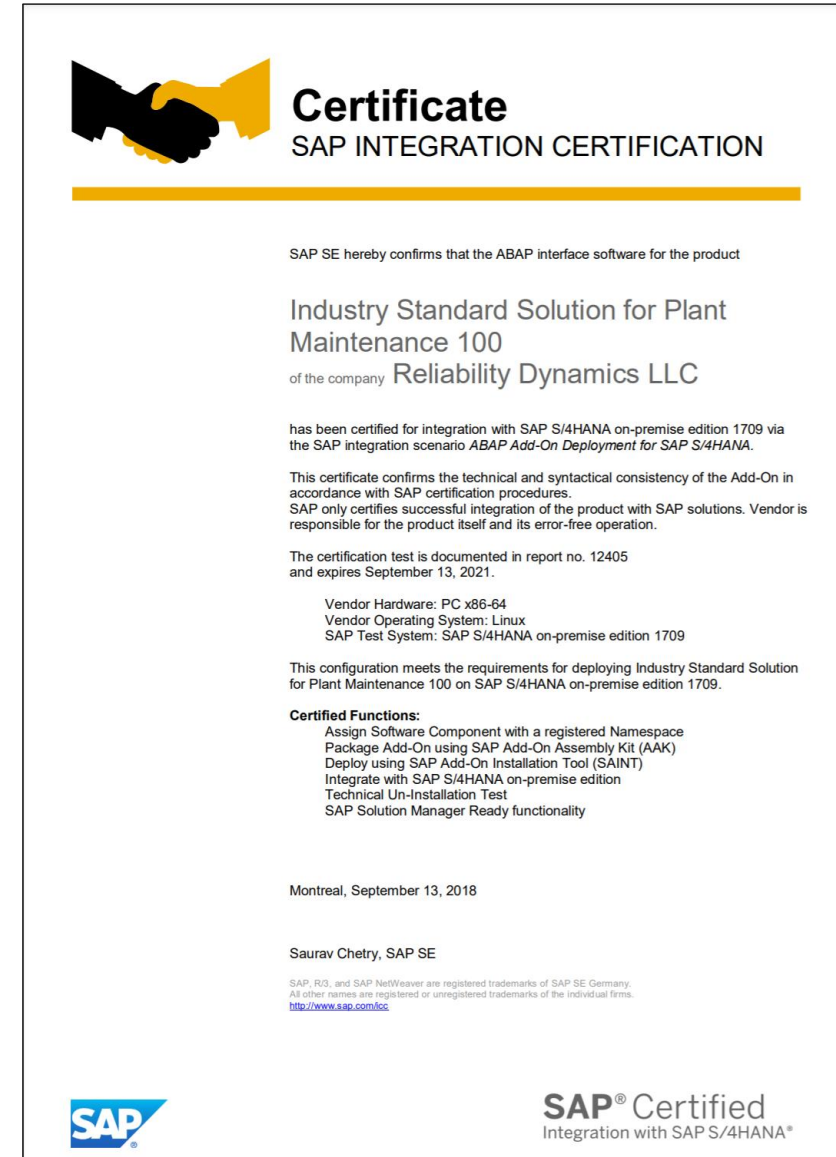
ISPM
Add-on for SAP

The ISPM Add-on for SAP

- SAP solution extension, certified for ECC and S/4HANA¹
- Compliant application of the ISO 14224:2016 standard in SAP²
- Tried, tested, and refined through 19 years of application in industry

Notes:

1. Link to [SAP ICC Test Report](#)
2. Conforms with ISO/TC67/WG4/PG1 guidance to industry, in ISO Course [Use of ISO 14224 for optimizing Safety and Profitability in the Oil and Gas Industry – in a digitalized perspective.](#)



ISPM Objectives and Business Benefits

Objectives

- Digitalize manually-captured equipment performance data
- Enable system-driven data quality management
- Generate corporate metrics and get actionable insights for equipment
- Make better (data-driven) decisions for equipment assets

Business benefits

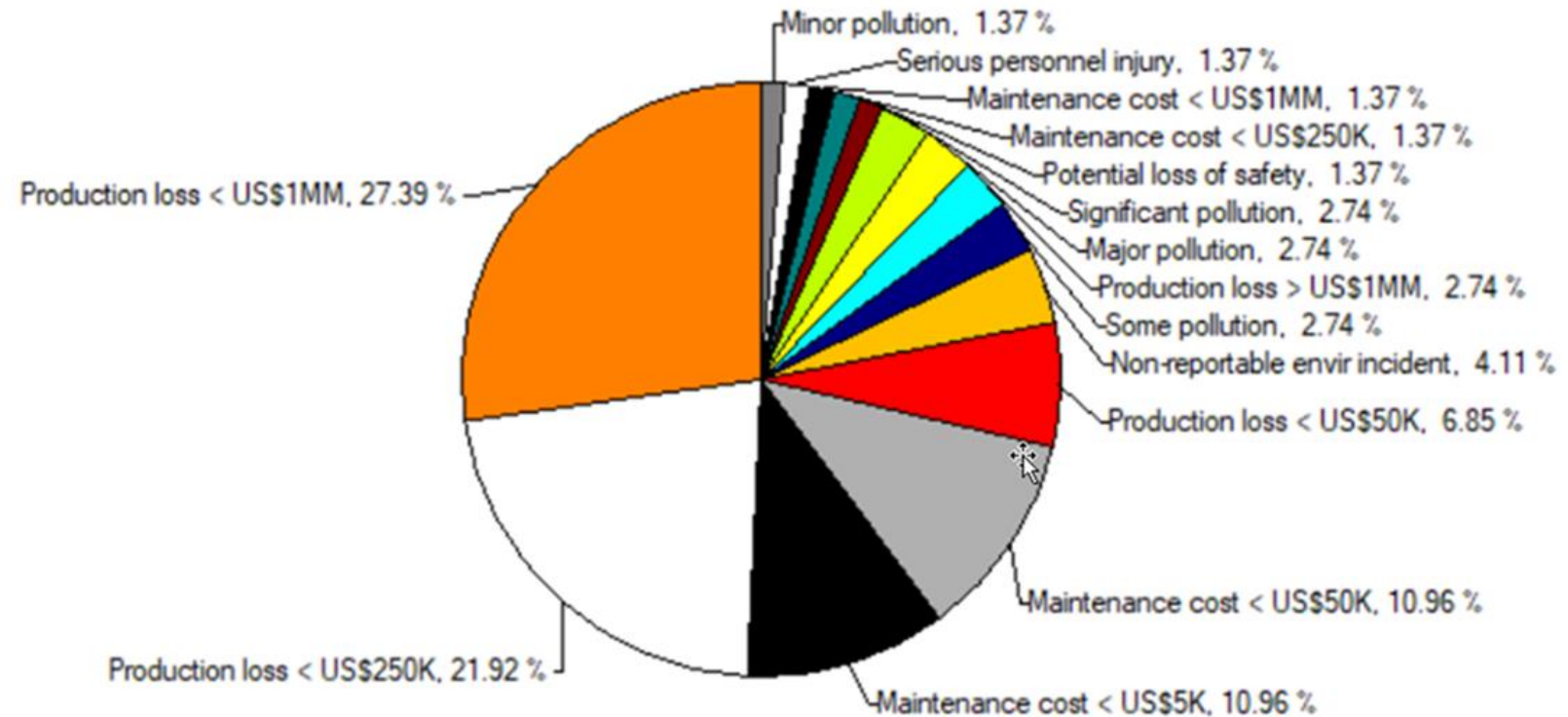
- Reduced operational risk
- Improved production throughput and profitability

Failure Events versus Consequences - Corporate

Key Business Metrics

SAP Report IW69

- Corporate view of data
- Drillable to failure details



Value set adapted from ISO
14224:2016, Table C.2

Breakdown Analysis/Repair Time KPIs

SAP Report MCJC

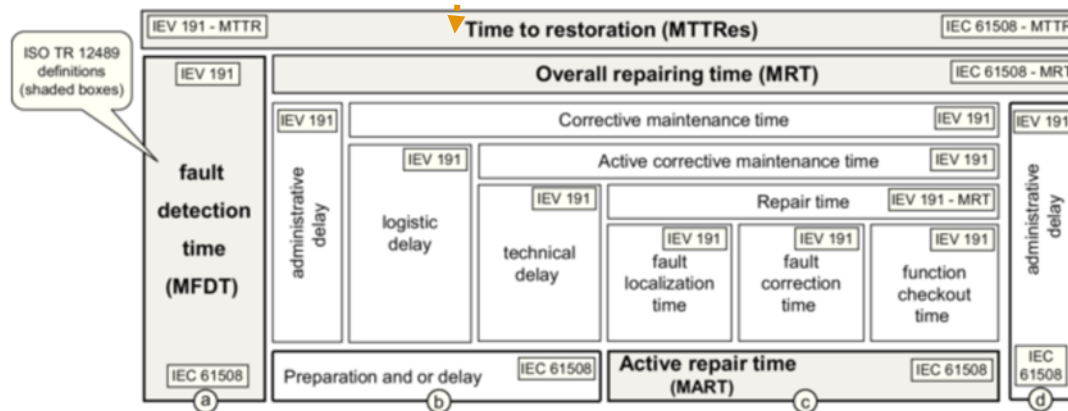
PMIS: MTTR/MTBR - Functional Location

ISO 14224:2016, Clause 3.64 MTTRes

ISO 14224:2016, MTBR-KPI 3

Functional Location	Mean Time To Repair (H)	Period Breakdowns	Downtime (H)	MTTR (H)	MTBR (H)
212410-CMP-0001	34.41	COMPACTOR 1	10,003.93	2,000.79	
2021.01	1	48.93	48.93	6,279.07	
2021.03	1	8.73	8.73	1,391.27	
2021.04	1	71.17	71.17	840.83	
2021.05	1	36.88	36.88	563.12	
2021.06	1	6.35	6.35	929.65	
* 212410-CMP-0001	5	172.07			

Figure 5 — Repair time taxonomies as per IEC 61508^[14] and ISO/TR 12489



ISO/TR 12489:2013(en)

Petroleum, petrochemical and natural gas industries — Reliability modelling and calculation of safety systems

ISO 14224:2016

Table E.3 — Examples of KPIs^a

KPI	Relevant taxonomic levels ^b	Units	Explanation and calculation	Purpose and value	Involved personnel
1) METBF Mean elapsed time between failures	6 to 8	Time (hours, days, weeks, months, years) For different classes or types of equipment Trends are shown over a period of time	Indicates the average time between failure for components, equipment or units. Definition of failure is given in Clause 3 (general) and Annex F (safety equipment). Use of METBF implies that down time/repair is included. Guidelines for calculating METBF (and MTTF) are given in Annex C.	Indication of increasing or decreasing reliability of components, equipment or unit/plant	Equipment subject-matter experts (SMEs) Reliability engineers (REs) Middle management (MM) Inspection
2) MTTF Mean time to failure	6 to 8	As above	Is similar to METBF, but does not take into account the down time/repair time. METBF is the sum of MTTRes and MTTF. MTTF equals the reciprocal of the failure rate.	As above Note that MTTF, in principle, concerns only the first time to failure of a new item before any maintenance task has been performed	As above
3) MTBR Mean time between repairs	6 to 8	Time (hours, days, weeks, months, years) For different classes or types of equipment Trends are shown over a period of time	Indicates the average time between repairs for components, equipment or units. Although a failure typically results in a repair, this is not always the case. Repairs (e.g. major overhauls) can be undertaken on a time basis independent of failure. Calculation based on total time between repairs divided by number of repairs over a specified time period or to date. For subsea equipment, one may rename the KPI to "Mean time between interventions" (MTBI).	Indication of increasing or decreasing reliability of components or equipment within a plant/unit	SMEs REs MM Maintenance Inspection

^a Other/more KPIs can be useful depending on industry and application.
^b See Table E.2.
^c CM is sometimes used as an abbreviation for corrective maintenance, but in this document CM refers to Condition monitoring

How the ISPM enables high-quality decision-making for equipment assets

Equipment Reliability Data Quality Management

Quality Assurance

- Proactive measures to increase the likelihood data records are compliant with specifications
- System-driven, at data inception

Quality Control

- Review of completed records to ensure data compliance
- Feedback to relevant personnel



ISPM Data Harmonization in ECC and S/4

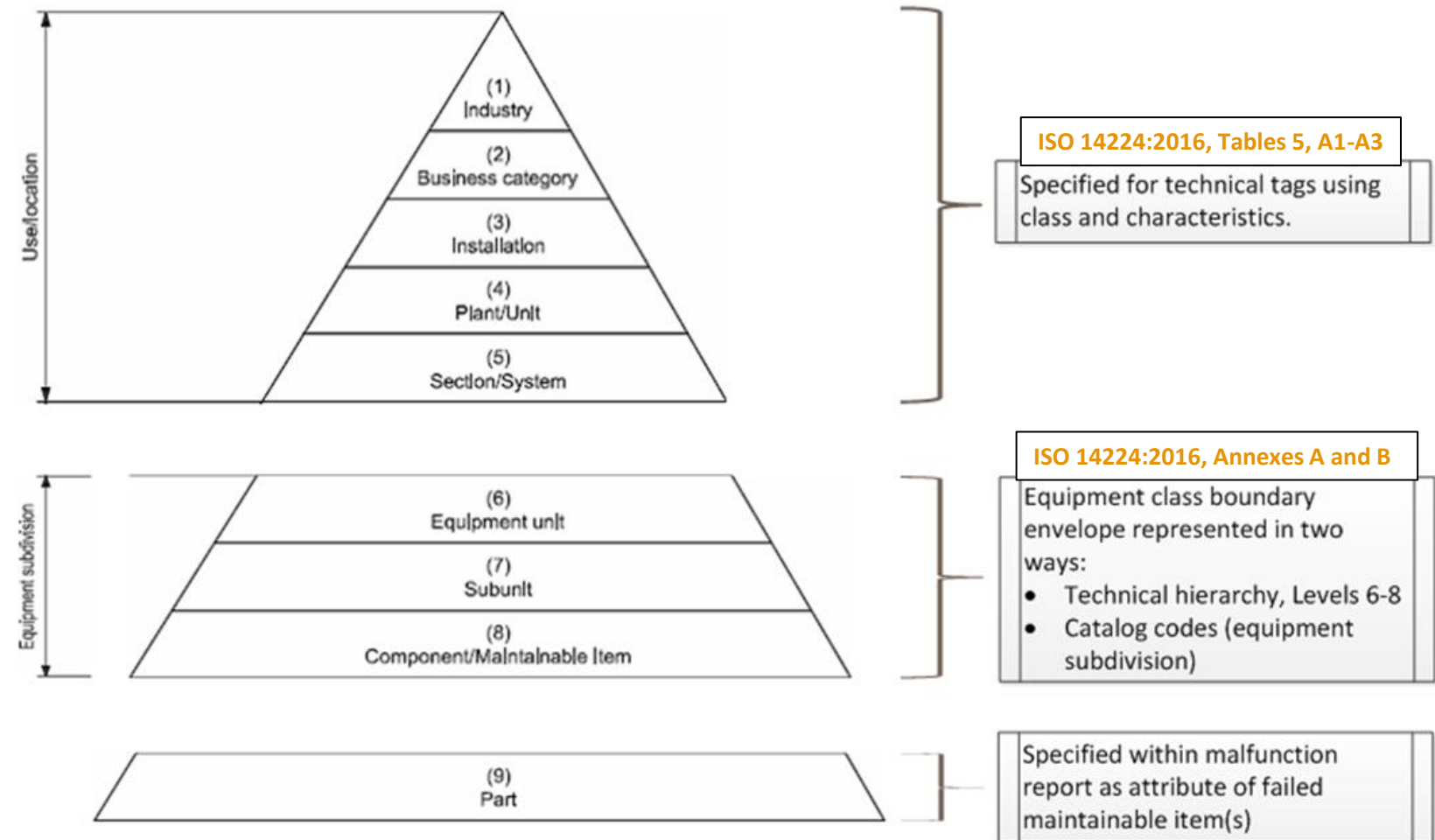
- An ISO 14224:2016 compliant data structure to digitalize manually collected equipment performance data
- Standard content
 - Taxonomy definitions and master data content in digitalized format
 - Standard data mapping and schemata
- Failure data aggregation to the equipment unit level
- Data quality management (data governance)

See further details in the [ISPM Storyboard](#)

ISO 14224

Data Mapping

ISO 14224:2016 Figure 3 — Taxonomy classification with taxonomic levels

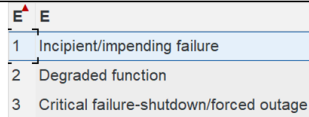
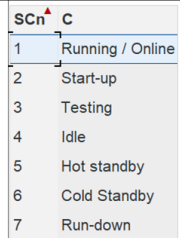
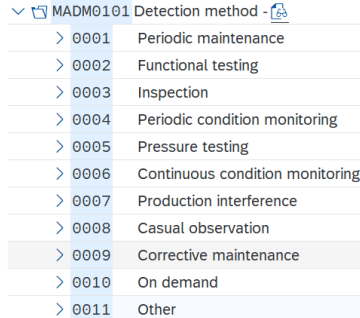


Standard Data Mapping

Establishes Data Interoperability

- Ensures consistency in solution application
- Enables standard data validations
- Enables meaningful merging and assessment from different sources

ISO 14224 data specifications and mapping (partial set)

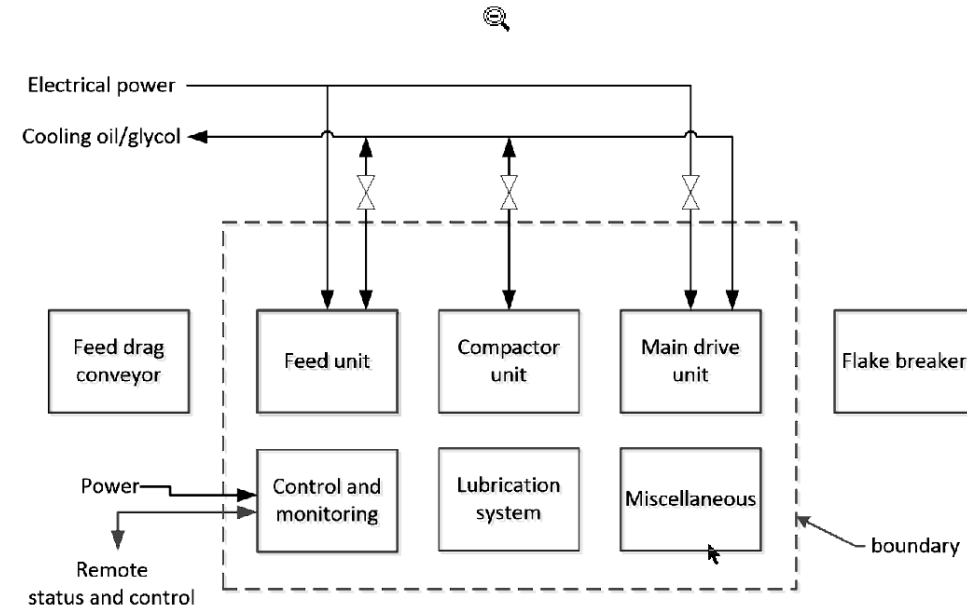
Required datum	Maintenance category	Screen field	Value set	Specification	Processing stage
Failure mode code group	Corrective maintenance	VIQMEL-QMGRP	Standard catalog schemata, specified for the relevant equipment class	ISO 14224, Table 6 and Annex B	Create/Edit/Close
Failure mode code	Corrective maintenance	VIQMEL-QMCOD	Annex B, specified for the relevant equipment class	ISO 14224, Table 6 and Annex B	Create/Edit/Close
Failure effect	Corrective maintenance	VIQMEL-AUSWK		ISO 14224, Table 6	Create/Edit/Close
Condition before malfunction	Corrective maintenance	VIQMEL-ANLZV		ISO 14224, Table 6	Create/Edit/Close
Detection method code group	Corrective maintenance	VIQMMA-MNGRP	Standard catalog schemata, specified for the relevant activity	ISO 14224, Table 6 and Annex B	Create/Edit/Close
Detection method code	Corrective maintenance	VIQMMA-MNGRP		ISO 14224, Table 6 and Annex B	Create/Edit/Close

Equipment Taxonomy with Schemata and Data Mapping

Equipment Class: Compactors, agglomeration

Taxonomy ID: PE_ME_CP

Equipment Types	Taxonomy ID
Compactors, fixed gap	PE_ME_CP_FI
Compactors, floating gap	PE_ME_CP_FL



Boundary definition – Compactors

AGCO0100	Compactors
SCG	SCG_TXT
AGCO0100	Feed unit
CODE	MITXT
0001	No detail
0100	Frame and housing
0200	Force feeder screw
0300	Drive motor
0400	Gearbox
0500	Drive coupling
0600	Inspection/Access door
AGCO0200	Main drive unit
CODE	MITXT
0001	No detail
0100	Motor
0200	Gearbox
0300	Motor base
0400	Shaft guard
0500	Footing/Mounting
AGCO0300	Compactor unit
CODE	MITXT
0001	No detail
0100	Roll
0200	Roll bearings
0300	Hydraulic system
0400	Frame and housing
0500	Discharge chute
0600	Inspection/Access door
AGCO0400	Control and monitoring
CODE	MITXT
0001	No detail
0100	Actuating device
0200	Control unit
0300	Internal power supply
0400	Monitoring
0500	Sensors
0600	Valves
0700	Wiring
0800	Piping
0900	Seals
AGCO0500	Lubrication system
CODE	MITXT
0001	No detail
0100	Heater
0200	Reservoir(s)
0300	Pump(s)
0400	Motor
0500	Filter
0600	Temperature control
0700	Valves
0800	Piping
0900	Oil cooler
1000	Oil
1100	Sensors
1200	Wires
AGCO9900	Miscellaneous
CODE	MITXT
0001	No detail
0100	Baseplate
0200	Foundation
0900	Other

Classification Structure

Class Structure

EQ	All equipment
GP	General application
NP	Non process equipment
PE	Process equipment
PE_CO	Communications Equipment
PE_ME	Mechanical
PE_ME_AT	Atmospheric tanks
PE_ME_BU	Buildings
PE_ME_CR	Cranes
PE_ME_HE	Heat exchangers
PE_ME_LA	Loading arms
PE_ME_OC	Overhead cranes
PE_ME_PI	Piping
PE_ME_SE	Steam ejectors
PE_ME_SW	Swivels
PE_ME_WI	Winches
PE_ME_WS	Water screen systems
PE_ME_CP	Compactors, agglomeration
PE_ME_CP_FL	Compactors, floating gap
PE_ME_CP_FI	Compactors, fixed gap
PE_ME_CV	Conveyors
PE_ME_HB	Heaters and boilers
PE_ME_HS	Hoses
PE_ME_MB	CALM buoys (SPM)
PE_ME_PL	Pipeline
PE_ME_TA	Storage tanks
PE_ME_TU	Turrets
PE_ME_VE	Vessels
PE_EL	Electrical
PE_HS	HSE equipment
PE_LA	Lifting appliances
PE_RO	Rotating equipment

Characteristics: Compactors, functional

A	B	C	D
1	Characteristic Name	Char. description	Characteristic Inherited
2	MAX_PRESSING_FORCE	Maximum pressing force	
3	ROLLER_DIAMETER	Roller diameter	
4	EXTRUSION_THICKNESS	Extrusion thickness	
5	ROLLER_SPEED_RANGE	Roller speed range	
6	ROLLED_SHEET_OUTPUT_MAX	Maximum rolled sheet output	
7	GRANULAR_SIZE_RANGE	Maximum granular size	
8	FINAL_PRODUCT_OUTPUT_MAX	Maximum product output	
9	TOTAL_MAIN_DRIVE_POWER	Total main drive power	
10	INDUSTRY	Industry	EQ
11	BUSINESS_CATEGORY	Business category	EQ
12	INSTALLATION_CATEGORY	Installation category	EQ
13	PLANT_UNIT_CATEGORY	Plant/Unit category	EQ
14	SECTION_SYSTEM	Section/System	EQ
15	OPERATION_CATEGORY	Operation category	EQ
16	NO_REDUNDANT_UNITS	Number of redundant units	EQ
17	NORMAL_OPERATING_MODE	Normal operating mode	EQ
18	AMBIENT_CONDITIONS	Ambient conditions	EQ
19	UTILIZATION_OF_CAPACITY	Utilization of rated capacity	EQ
20	RELEVANT_STANDARDS	Relevant Standards and Regs	EQ
21	PID_NUMBER	Process and Instr. Diagram No.	EQ
22	LEGACY_ID	Legacy ID	EQ

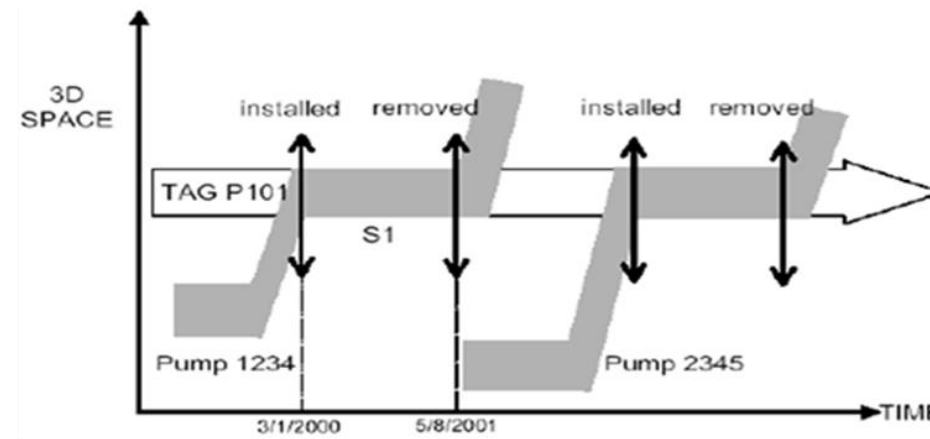
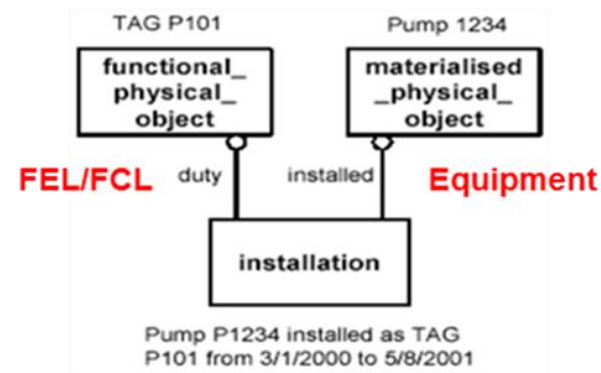
Value set adapted from ISO 14224:2016, Table A.4

Value set: Section/System

SECTION_SYSTEM	
Display Hierarchy	Description
> 06	General utilities
> 07	Auxiliaries
> 08	Fertilizer
> 08.01	Mining and extraction (ME)
> 08.01.01	ME Sub-Surface
> 08.01.02	ME Hydro
> 08.01.03	ME Surface
> 08.01.04	ME In-situ Leaching
> 08.01.05	ME Dredging
> 08.02	Processing plant
> 08.02.01	Ore crushing and pre-screening
> 08.02.02	Ore milling and pre-sizing
> 08.02.04	Sylvite flotation
> 08.02.05	NaCl leaching from floatn conc
> 08.02.06	Hydro-thkg & dehy of tailings
> 08.02.07	Hydro-sizing & dehy of conc
> 08.02.08	Concentrate drying
> 08.02.09	Preparation of chemicals
> 08.02.10	Granulation of KCL
> 08.02.11	Granules refining

Functional Location / Equipment Relationship

ISO 15926-2:2003, Section E.3.3¹



The duty represented by TAG P101, and Pump 1234 are coincident for the period of the installation, i.e. the state S1 of Pump 1234 that is installed as TAG P101 is in fact also a state of TAG P101. TAG P101 consists of those states of the pumps that are installed in this location.

ISO 15926-2 (Data Model) Industrial automation systems and integration—Integration of life-cycle data for process plants including oil and gas production facilities, Figures E.9 and E.10.

1. ISO 15926-2, Section E3.3 is referenced in ISO 14224:2016, Table 5, Footnote b.

Data Digitalization and Qualification

Malfunction Problem Report Example

- Logical work categorization, with one input form per category¹
- Specifications of required data per work category^{2,3,4}
- Discrete fields with structured input for each required datum
- System-validations to ensure compliance with specifications

Notes - ISO 14224:2016

1. Figure 6 – Maintenance categories
2. Table 6 – Failure data
3. Table 8 – Maintenance data
4. Table 3 – Reliability and maintenance parameters in relation to taxonomy levels

System validation of compliance with ISO 14224:2016, Tables 3, 6, and 8

Message text

- Equipment condition before malfunction is required.
- Effect on system operation is required.
- Notification priority is required.
- Failure mode is required.
- Notification short text is required.
- Detection method required.
- Functional Location Category must be 6, 8 or 9.

Catalog Selection

- Failure Mode Failure mode coding
 - AGC00100 Compactors - [Failure mode coding]
 - AIR Abnormal instrument reading
 - BRD Breakdown
 - ELU External leakage utility medium
 - FTS Fail to start on demand
 - LOO Low output
 - NOI Noise
 - OHE Overheating
 - OTH Other
 - PDE Parameter deviation
 - PLU Plugged/choked
 - POW Insufficient power
 - SER Minor in-service problems
 - STD Structural deficiency
 - STP Fail to stop on demand
 - UNK Unknown
 - UST Spurious stop
 - VIB Vibration

Performance Assistant

Effect on Operation

Effect of the problem or malfunction on the operation of the affected system

Use

ISO 14224 Methodology

ISO 14224 Methodology

Effect on operation refers to how the equipment malfunction effects its own operation. Operational effect in this context is categorized as follows:

1. Incipient/impending failure: imperfection in the state or condition of an item so that a degraded or critical failure might (or might not) eventually be the expected result if corrective actions are not taken.
2. Degraded function: failure that does not cease the fundamental function(s), but compromises one or several functions.
3. Critical failure-shutdown/forced outage: failure that causes a complete shutdown of the equipment or a forced outage.

Discrete fields with structured input for all required data, ISO 14224:2016, Tables 6 and 8

Reliability and maintenance terms, from ISO 14224:2016, Clause 3

SCn C

- 1 Running / Online
- 2 Start-up
- 3 Testing
- 4 Idle
- 5 Hot standby
- 6 Cold Standby
- 7 Run-down

Notification %00000000001 M2 Drive gear overheating

Status OSNO [i] APRQ

Order [i]

Problem Report Detection Method Planning Documents

Reference object

Functional loc. 212410-CMP-0001 COMPACTOR 1

Equipment 10127672 Compactor, 1600-HP

Assembly I

Start/End Dates

Required Start 2021.06.28 17:05:42 Priority 1-Very high

Required End 2021.06.29 16:05:42

Subject

Failure Mode AGC00100 OHE Compactors - Overheating

Description Drive gear overheating

2021.06.28 16:09:07 Tony Ciliberti (TCILIBER)
Drive gear 1 is running hot.

Effect on the system

Funct. loc. affected 212410-CMP-0001

Effect 3 Critical failure-shutdown/forced outage

System

Avail. 100 Cond.bef.malfuncn 1 Running

Malfunction

Malfunction 06.28 15:58:12 Breakdown

Malfunction 00:00:00 Breakdown dur.

Data Digitalization and Qualification

Malfunction Repair Report Example

Validations check compliancy with ISO 14224:2016, Tables 6 and 8, on notification completion

Notification
10001386
M2
Drive gear overheating

Status
NOPR
APPR

Order

Problem Report
Repair Report
Activities
Planning
Documents

Maintainable Items
Failure Cause
Activities

No.	Code group	Mai...	Maint Items	Code group	Fail...	Failure Mech	Text	It...	Assembly	Assembly Descriptn
1	AGCO0200	0200	Main drive unit - Gearbox	FM000200	2.5	Material failure - Breakage	Bearing failure	21		BEARING, RADIAL

Maint Items
Maintainable item coding

AGCO0100 Feed unit -

AGCO0200 Main drive unit -

0001 No detail

0100 Motor

0200 Gearbox

0300 Motor base

0400 Shaft guard

0500 Footing/Mounting

AGCO0300 Compactor unit -

AGCO0400 Control and monitoring -

AGCO0500 Lubrication system -

AGCO9900 Miscellaneous -

Failure Mech
Failure mechanism coding

FM000100 Mechanical failure -

FM000200 Material failure -

2.0 General

2.1 Cavitation

2.2 Corrosion

2.3 Erosion

2.4 Wear

2.5 Breakage

2.6 Fatigue

2.7 Overheating

2.8 Burst

FM000300 Instrument failure -

FM000400 Electrical failure -

FM000500 External influence -

FM000600 Miscellaneous -

M2 Notification 10001386: Display messages

Type
Message text

Malfunction end date required.
Failure mechanism is required.
Maintainable item is required.
Corrective maintenance activity is required.
Failure cause code is required.

Display Long Text

- 1 -

MATERIAL FAILURE

2.0 GENERAL: a failure related to a material defect, but no further details known.

2.1 CAVITATION: relevant for equipment such as pumps and valves.

2.2 CORROSION: all types of corrosion, both wet (electrochemical) and dry (chemical)

2.3 EROSION: erosive wear

2.4 WEAR: abrasive and adhesive wear, e.g. scoring, galling, scuffing, fretting.

2.5 BREAKAGE: fracture, breach, crack

2.6 FATIGUE: if the cause of breakage can be traced to fatigue, this code should be used.

2.7 OVERHEATING: material damage due to overheating/burning.

2.8 BURST: item burst, blown, exploded, imploded, etc.

Data Digitalization and Qualification

Consequence Classification Example

Object

Notification Item number Bearing failure

Class Type Message item

Values for Class PE_ME_CP - Object 10001386 0001

General Risk Customer

Characteristic Description	Value
☐ Failure Consequences	Production loss < US\$1MM
☐ Equipment/Area affected	4013
☐ Facility downtime	36 hrs

Value Hierarchy for Char. Failur...

	Desc.
☐ ☒ Failure Consequences	
☐ > ☐ E	Environment
☐ > ☐ O	Operations
☐ > ☒ P	Production
☐ > ☐ P1	Production catastrophic
☐ > ☒ P2	Production severe
☐ > ☒ P21	Production loss < US\$1MM
☐ > ☐ P3	Production moderate
☐ > ☐ P4	Production minimal
☐ > ☐ P5	Production negligible
☐ > ☐ S	Safety

ISO 14224:2016, Table C.2 – Failure consequence classification

Consequences	Category			
	Catastrophic Failure that results in death or system loss	Severe Severe injury, illness or major system damage	Moderate Minor injury, illness or system damage	Minor Less than minor injury, illness or system damage
Safety	I — Loss of lives — Vital safety-critical systems inoperable	V — Serious personnel injury — Potential for loss of safety functions	IX — Injuries requiring medical treatment — Limited effect on safety functions	XIII — Injuries not requiring medical treatment — Minor effect on safety function
Environmental	II Major pollution	VI Significant pollution	X Some pollution	XIV No, or negligible, pollution
Production	III Extensive stop in production/operation	VII Production stop above acceptable limit ^a	XI Production stop below acceptable limit ^a	XV Production stop minor
Operational	IV Very high maintenance cost	VIII Maintenance cost above normal acceptable ^a	XII Maintenance cost at or below normal acceptable ^a	XVI Low maintenance cost

^a It is necessary to define acceptable limits for each application.

Six common issues that cause poor equipment performance data quality

Issue 1: Lack of Digitalization

Digitization

- Converting hard-copy or non-digital records into digital format

Digitalization

- The conversion of data into a digital form that can be processed by a computer
- Data stored in relational data tables as discrete values
- A subset of digitization

Data Storage Technology			
	Paper	Digitized	Digitalized
Format	Manual files	Images, scans, spreadsheets, unformatted text	Relational data tables
Storage	File Cabinet	Corporate software	Corporate software
Data accessibility, records/analysis	1	1	100,000+
System validations possible	No	No	Yes

Issue 2: Lack of Common Terms and Definitions

- Common terms and definitions are imperative for collecting, merging and analyzing data from different sources
- Otherwise, the merging and analysis is based on incompatible data

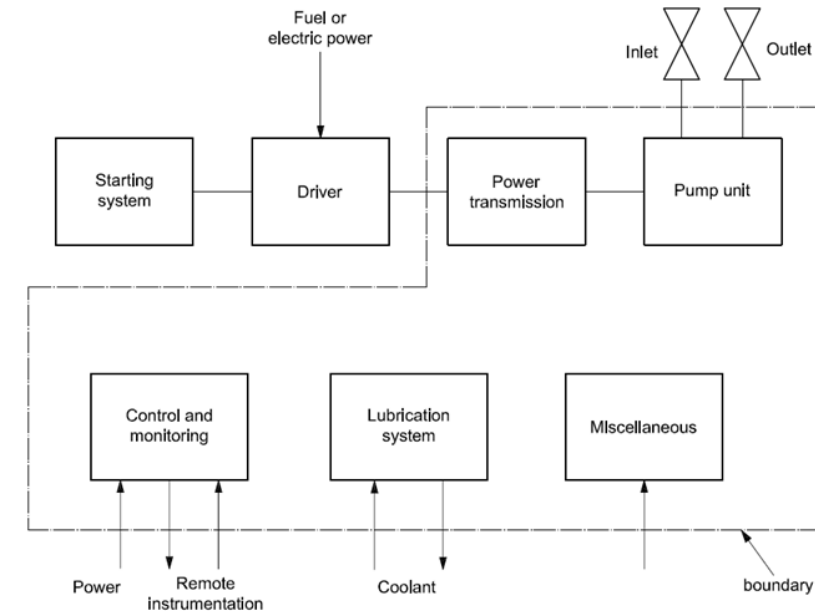


Figure A.7 — Boundary definition — Pumps

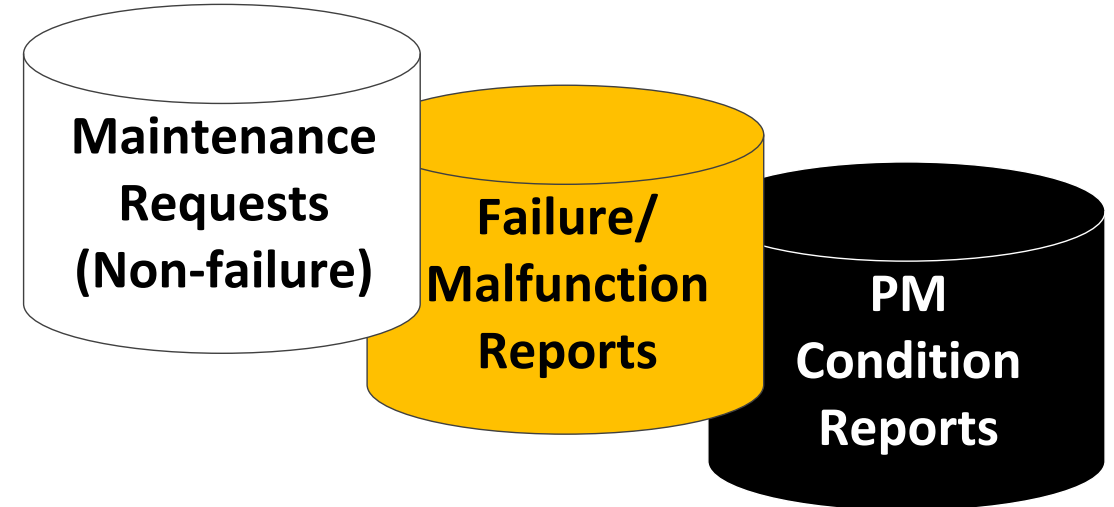
Table A.21 — Equipment subdivision — Pumps

Equipment unit	Pumps				
Subunit	Power transmission	Pump unit	Control and monitoring	Lubrication system	Miscellaneous
Maintainable items	Gearbox/variable drive	Support	Actuating device	Reservoir	Purge air
	Bearing	Casing	Control unit	Pump	Cooling/heating system
	Seals	Impeller	Internal power supply	Motor	Cyclone separator
	Coupling to driver	Shaft	Monitoring	Filter	Pulsation damper
	Coupling to driven unit	Radial bearing	Sensors ^a	Cooler	Flange joints
	Belt/sheave	Thrust bearing	Valves	Valves	
		Seals	Wiring	Piping	
		Valves	Piping	Oil	
		Piping	Seals	Seals	
		Cylinder liner			
		Piston			
		Diaphragm			

^a Specify type of sensor, e.g. pressure, temperature, level, etc.

Issue 3: Improper Maintenance Categorization

- Many companies combine dissimilar work in the same data collection form
 - E.g., maintenance requests and failure/malfunction reports
 - Different data requirements in the same form cannot be system-validated
 - Metrics require manual separation of records
- Data sets should align with maintenance categorization
 - ISO 14224:2016, Figure 6



System data validations – malfunction report initiation

Typ	Message text
●	Equipment condition before malfunction is required.
●	Effect on system operation is required.
●	Notification priority is required.
●	Failure mode is required.
●	Notification short text is required.
●	Detection method required.
●	Functional Location Category must be 6, 8 or 9.

Validations check compliancy with ISO 14224:2016, Tables 3, 6, and 8

Issue 4: Lack of Data Specifications

- Data specifications for digitalization
 - What to collect
 - How to collect it
- In the data collection form
 - Create a discrete field with structured input for each datum
 - System-validate compliance with specifications

Table 6 — Failure data

Data category	Data to be recorded	Description
Identification	Failure record (*)	Unique failure record identification
	Equipment identification/Location (*)	E.g. tag number (see Table 5)
Failure data	Failure date (*)	Date of failure detection (year/month/day)
	Failure mode (*)	Usually at equipment-unit level (level 6) (see B.2.6) ^a
	Failure impact on plant safety (e.g. personnel, environment, assets) ^b	Qualitative or quantitative failure consequence categorization (see also C.1.10)
	Failure impact on plant operations (e.g. production, drilling, intervention) ^b	Qualitative or quantitative failure consequence categorization (see also C.1.10)
	Failure impact on equipment function (*)	Effect on equipment-unit function (level 6): critical, degraded, or incipient failure ^c
	Failure mechanism	The physical, chemical or other processes which have led to a failure (see Table B.2)
	Failure cause ^d	The circumstances during design, manufacture or use which have led to a failure (see Table B.3)
	Subunit failed	Name of subunit that failed (see examples in Annex A)
	Component/Maintainable item(s) failed	Name of the failed component/maintainable item(s) (see Annex A)
	Detection method	How the failure was detected (see Table B.4)
	Operating condition at failure (*)	Run-down, start-up, running, hot standby, idle, cold standby, testing
	Operational phase at failure ^e	Type of operation at the time of failure
	SIS failure mode classification ^f	Classify the failure for the specific event (DU, DD, SU, SD; see F.2) ^g
Remarks	Additional information	Give more details, if available, on the circumstances leading to the failure: failure of redundant units, failure cause(s) etc.

Issue 5: Lack of Use/Location Data

Use/Location data

- Specify how equipment is used (operating context)
- Are essential for merging data and assessing equipment performance

Object

Functional loc.	LLAK-8400-P-002-A		
Description	HP BFW PUMP A		
Class Type	003		Functional Location

Assignments

Class	Description	Stan...	S...	Icon	Itm
PE_RO_PU_CE	Pumps, centrifugal	☐	1		30

Entry 1 /

Plant/Unit category

Values for Class PE_RO_PU_CE - Object LLAK-8400-P-002-A

Use/Loc Coincident Reference

Characteristic Description	Value
Industry	Petroleum
Business category	Upstream (E&P)
Installation category	SAGD facility (onshore)
Plant/Unit category	Onshore prd plt-nonconv wells
Section/System	Steam
Operation category	Manned
Number of redundant units	2 EA
Normal operating mode	Running
Utilization of rated capacity	100 %
Coupling type	Flexible

Value Hierarchy for Char. Plant/Unit category

Value Hierarchy for Char. Plant/Unit category	Desc.	Text
Plant/Unit category	No Entry	
01	Upstream (E & P)	
01.01	Drilling	
01.02	Offshore	
01.03	Maritime	
01.04	Onshore	
01.04.01	Onshore prd plt-conv wells	
01.04.02	Onshore prd plt-nonconv wells	
02	Midstream	
03	Downstream	
04	Petrochemical	

Value set adapted from ISO 14224:2016, Table A.2

Issue 6: Lack of Failure Data Aggregation

- Equipment unit is the ISO 14224 common reporting level
- Equipment unit failure metrics are the aggregate of all failures within the equipment boundary

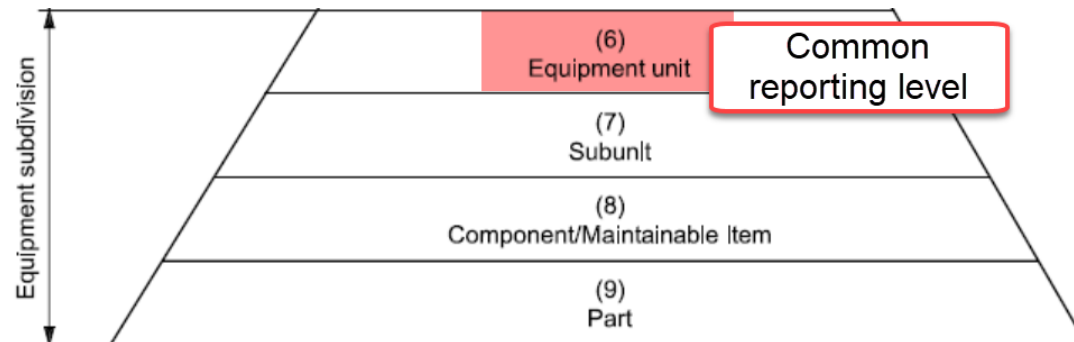


Figure 3 — Taxonomy classification with taxonomic levels

5 LLAk-8400-P-002	HP BFW PUMPS	Pump Boundary
6 LLAk-8400-P-002-A	HP BFW PUMP A	
10055213	PUMP-UTILITY GRADE, MULTISTAGE, RING SEC	
7 LLAk-8400-P-002-A-02	PUMP UNIT	
7 LLAk-8400-P-002-A-03	CONTROL AND MONITORING	
5 LLAk-8421-CM-200	8400-P-002A HP BFW PUMP SUCTION	
5 LLAk-8421-CM-201	8400-P-002A HP BFW PUMP SUCTION	
5 LLAk-8421-CM-202	8400-P-002A HP BFW PUMP DISCHARGE	
5 LLAk-8421-CM-203	8400-P-002A HP BFW PUMP WARM-UP	
5 LLAk-8421-CM-213	8400-P-002A HP BFW PUMP	
8 LLAk-8421-TE-213-A	ELEMENT, TEMPERATURE	
8 LLAk-8421-TE-213-B	ELEMENT, TEMPERATURE	
8 LLAk-8421-TT-213-A	TRANSMITTER, TEMPERATURE	
8 LLAk-8421-TT-213-B	TRANSMITTER, TEMPERATURE	
8 LLAk-8421-VXI-213	INDICATOR, VIBRATION	
8 LLAk-8421-VXT-213	VIBRATION PROXIMITOR	
8 LLAk-8421-VYI-213	INDICATOR, VIBRATION	
8 LLAk-8421-VYT-213	VIBRATION PROXIMITOR	
5 LLAk-8421-CM-215	8400-P-002A HP BFW PUMP QUENCH WATER	
5 LLAk-8421-CM-216	8400-P-002A HP BFW PUMP QUENCH WATER	
5 LLAk-8421-CM-217	8400-P-002A HP BFW PUMP BEARING OIL TO R	
5 LLAk-8421-CM-221	8400-P-002A COOLING MEDIUM RETURN	
5 LLAk-8421-CM-222	8400-P-002A COOLING MEDIUM RETURN	
7 LLAk-8400-P-002-A-04	LUBRICATION SYSTEM	
6 LLAk-8400-P-002-A-M	MOTOR-HP BFW PUMP A	
6 LLAk-8400-P-002-B	HP BFW PUMP B	
6 LLAk-8400-P-002-C	HP BFW PUMP C	
6 LLAk-8400-P-002-D	HP BFW PUMP D	
6 LLAk-8400-P-002-E	HP BFW PUMP E	

Poor Quality Equipment Performance Data

A Prevalent Issue



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Abstract

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Field maintenance data is often captured manually and is prone to having incomplete and inaccurate information in the structured fields. However, unstructured fields captured through work order planning, scheduling, and execution contain a wealth of historical information about asset performance, failure patterns, and maintenance strategies. The prevalent data quality issues...

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Thank you

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- PG1: ISO 14224 – Collection and exchange of reliability and maintenance data for equipment
- PG2: ISO 20815 – Production assurance and reliability management