



November 11, 2021

# RFID in Harsh and Hazardous Environments 2021

# Will it last? RFID and IoT Services for Harsh Environments

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## About ASSA ABLOY & HID Global



**ASSA ABLOY**

- The global leader in access solutions
- Operates in 70+ countries
- >49,000 employees
- >\$10 bn revenue

**HID**

- Top recognized brand for access control worldwide
- Headquarters in Austin, Texas
- >4,500 employees globally
- Billions of RFID products sold



- Identification Technologies (IDT) is a Business Area within HID Global
- Design & manufacturing of Smart Components
- Enabling identification solutions through services

# Types of harsh environments

and related standards



# Yard Management in Rugged Environments

Passive and active RFID tags can help identify and locate 100,000 or more assets — even across an industrial yard spanning several square miles.

Efficiently manage operations, inventory tracking, forecasting, and compliance. But to count the many, or locate the one, RFID tags need to meet the specific demands of the environment: whether it is a sub-zero temperatures or sweltering heat, exposure to seawater or extreme sunlight, challenging terrain or physical obstructions, or other factors.



## Vibration & Shock

Vibration when alternating force or motion is applied to a mechanical system. A mechanical or physical shock is a sudden acceleration or deceleration.



Vibration Test Area

See video: <http://www.youtube.com/watch?v=TIph8XHVIsA>



## Force

Tags are compressed with a defined force measured in Newton (N) for a defined time (usually 10 sec.)

# Specifications in Yard Management

# High-Impact Environments

RFID tags are tested in real-world situations and extreme conditions. RFID tags need to be tough enough to withstand whatever the weather — or drilling pipes, shipping containers, operators or other heavy objects — may throw at them.



# Impact Resistance

- IK rating is defined in EN 62262, measured in Joule
- Values range from IK00 (not tested) to IK10
- Polyamide object for  $IK \leq 6$ , steel for  $IK \geq 7$ . E.g.
  - IK04: Drop of 200g Polyamide object from 9.8 in / 25 cm (0.5J)
  - IK09: Drop of 5kg steel object from 7.8 in / 20 cm (10J)
  - IK10: Drop of 5kg steel object from 15.7 in / 40 cm (20J)



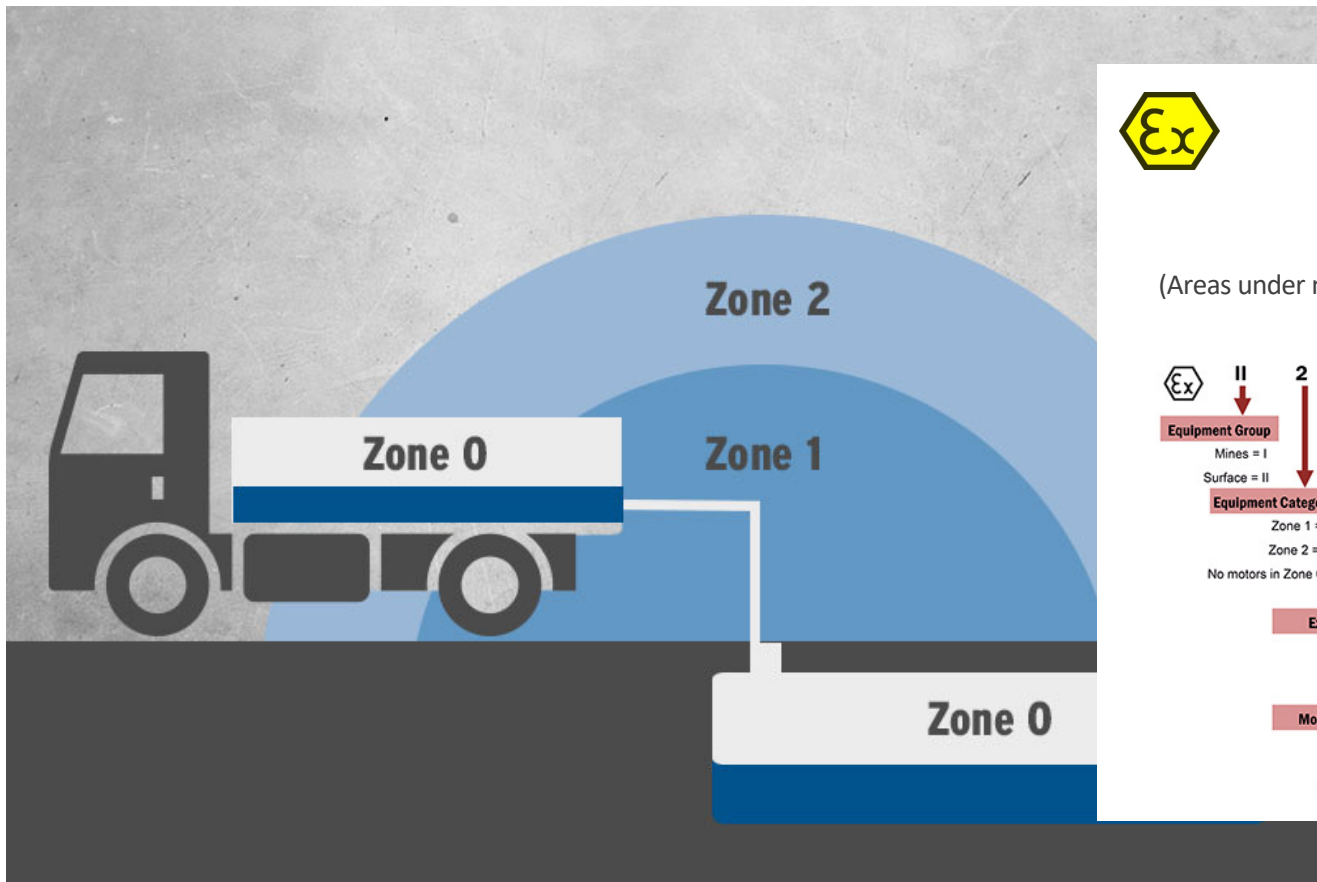
Video: <https://www.youtube.com/watch?v=wLBNLYUnd8>



# Explosive Environments

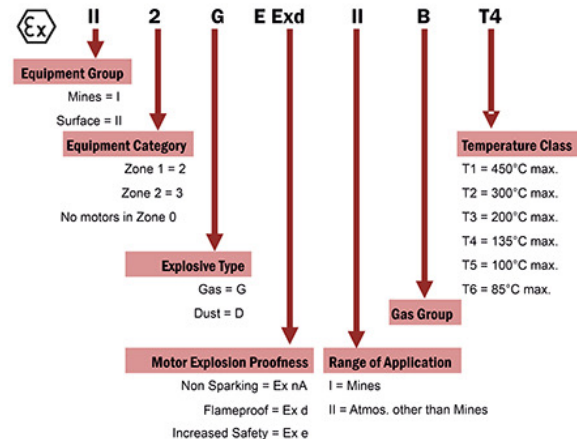
When munitions, gas, mining or other kinds of explosives are involved, make sure your RFID solutions are certified (ATEX, UKEx, and IECEx). Certified tags, readers and other equipment are safe to operate and will not cause an explosion e.g. due to overheating.





# ATEX Zones

- Zones 1 (gas) or 21 (dust)  
(Areas under normal operation can potentially form into explosive atmosphere)



# Extreme Temperature Environments

RFID tags can be optimized to endure extreme temperatures for special applications. Medical applications go down to  $-321^{\circ}\text{F}$  ( $-196^{\circ}\text{C}$ ) with Liquid Nitrogen and tags must be read at that low temperature to avoid damage to medical samples.

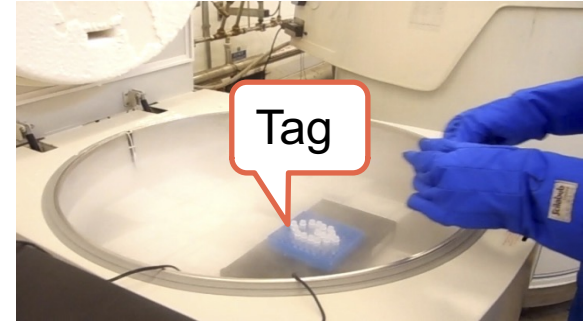
On the other hand, automotive paint shop processes or aircraft applications require heat and flame resistance up to  $437^{\circ}\text{F}$  ( $+225^{\circ}\text{C}$ ).



# Example: RFID Optimizes Cryogenic Storage of Medical Probes

- Two temperature ranges for long-term storage of bio-material
  - -321°F (-196°C) Liquid Nitrogen(LN2) for live samples like sperm, stem cells, egg cells, genetic reference samples
  - -112°F (-80°C) – Fridge for dead samples e.g. tissue probes
- Not all RFID chips work at these low temperatures
- Improper materials may crack
- RFID tags must be tiny and not interfere
- A tray of probes must be read at once and RF must not interfere with other equipment (no UHF)
- See [case study](#)

**HID HF Vigo™ Direct Bonding Technology meets all of the requirements**



Cryogatt RFID reader, reading a tray of vials at LN2 vapor phase temperature



HID Global Vigo™ Piccolino HF Tag in probe vials



# Flame Resistance - UL94 Hx

- UL 94 HB = IEC 60695-11-10 (former ISO 1210)
- A specimen is supported in a horizontal position and is tilted at 45°. A flame is applied to the end of the specimen for 30 seconds or until the flame reaches the 1 inch mark
- Material shall stop burning after flame is removed
- Material shall not melt or leave burning drops
- Different levels of flame resistance specified (HB, H2, H1, H0)
- Typically tested on housing material by material vendor



Video: <https://www.youtube.com/watch?v=wLLBNLYUnd8>



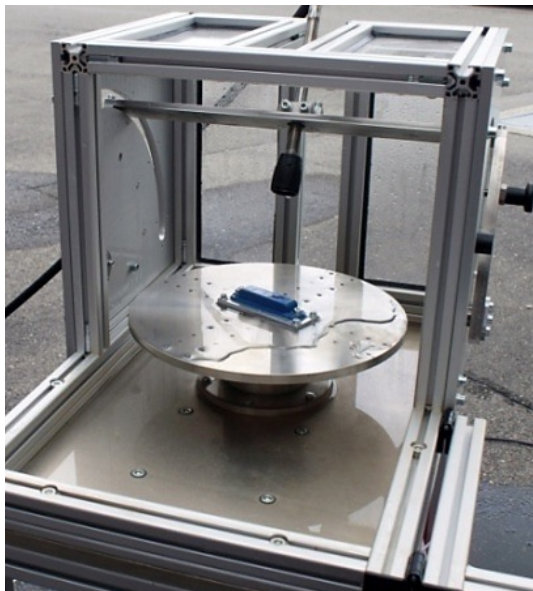
# Washing Environments

Water resistance can vary from splash water to heavy rain, to temporary or long-term submerging underwater to high-pressure power washing with almost cooking liquid. A tag that is waterproof does not necessarily withstand power washing and vice versa.



## IP 66, 67, 68

IP rating is defined in 2 digits: **Solid Particle Protection** and **Liquid Protection**. IP68 is typically associated with waterproof and tested by submerging the tag for 24h in 1-2m deep water basin.



## IP69K

Spray nozzle that is fed with 176°F / 80°C hot water at 8–10 Mpa (80–100 bar) and a flow rate of 14–16 L/min. The nozzle is held 10–15 cm from the tested device at angles of 0°, 30°, 60° and 90° for 30s each.

# Specifications in Washing Environments

# Environments with Chemical Exposure

RFID tags can withstand individual chemicals — but also the potential chemical combinations — whether just a splash, or repeated exposures, or submersion it is important to consider contamination factors.

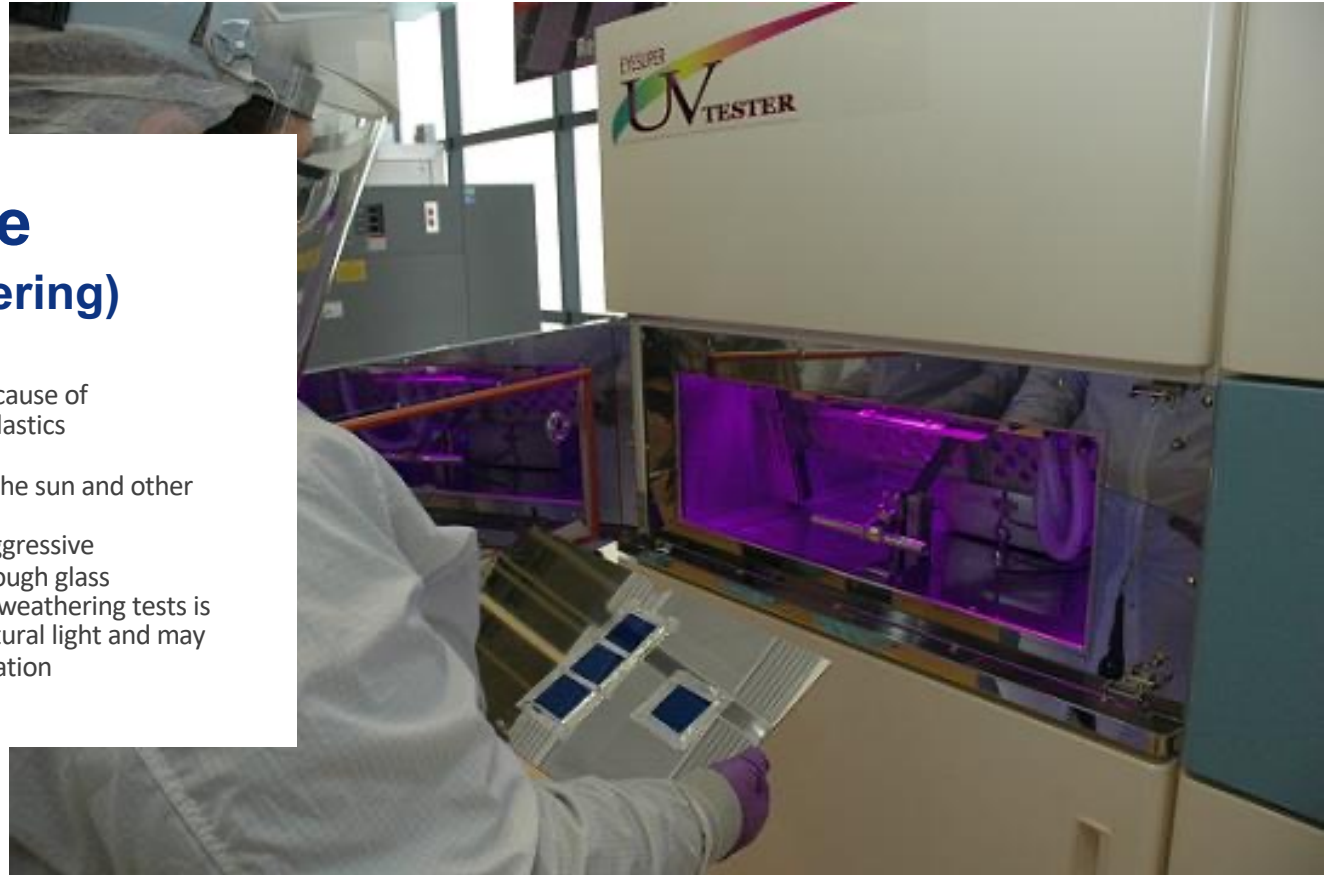




# UV Resistance

## ISO 4892-2 (Weathering)

- UV Light:
  - UV radiation is the main cause of discoloration of thermoplastics
  - Some plastics harden
  - UV light is generated by the sun and other light sources
  - Direct sunlight is more aggressive than sunlight filtered through glass
  - UV light in ~ accelerated weathering tests is more aggressive than natural light and may over-predict the discoloration



# Example: Offshore Drilling Inventory & Inspection



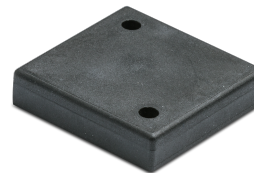
SlimFlex Tag OM

Drilling operators & equipment suppliers utilize RFID tags to identify different items on petroleum platforms

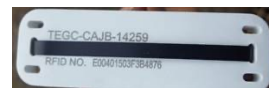
- for inventory / item identification
- for maintenance & inspection



PolyTag 340EX



IronTag 206F



# RFID in Mining

Examples from a harsh  
environment

# How RFID Systems Make Mining Safe, Secure and More Efficient ?

The mining industry is the oldest industries for worldwide and become a main economic contribution for many countries around the world. For example China, Australia, Indonesia, Malaysia and others.

Productive mine sites work 24 hours-a-day, are highly scrutinized for safety, and deal with shipments worth millions of dollars. The slightest mistake, accident or inefficiency can have massive repercussions for mine workers and the mining company. That's why leading mining firms around the world are turning to RFID systems to ensure their operations are safe, secure and more efficient.



## Safety

RFID helps ensuring proper equipment is used and RTLS ensures safety and compliance.



## Security

RFID readers and tags can be used to control entry to a site or equipment.



## Efficiency

RFID systems can significantly reduce maintenance downtime and help optimizing processes.



# Applications of RFID in Mining Industries

## ▪ Control of Personnel to Access Mining Sites

Main mission of logistics at mining places is to accomplish access control of personnel. On huge mining areas, many workers are mostly employed and on site concurrently. It also involves several vendors, subcontractors and guests. They might enter frequently to the mining area daily. The illegal individuals should be not permitted to enter to the mining site for the safety precaution, to prevent theft, and illegal employment in mining sites. In order to prevent it from happening, the mining areas are secure usually secured by a barrier or buffer zone. To solve this problem, the implementation of RFID technology become main vital aspect.

## ▪ Control of Personal Protective Equipment (PPE)

In mining industries necessitate the employees to wear PPE. The usual PPE consist of safety vests, gloves, steel-toed safety boots, clothing, ear plugs, hardhats, eyewear, masks, etc. Different work situations have different PPE requests that are referring to rules and regulations for compliance. In order to solve this problem, the RFID technology can be used, as a one step to create safety environment for the mining worker.

## ▪ RFID Solutions for Tracking Explosives

RFID technology is proper for inventory management of boosters and detonators, tracing of detonators and explosives, security and recovery of the assembly from the explosion debris in the case of a misfire. This technology is capable of tracking and monitoring of detonators and boosters, repossession of the explosive materials or detonator in case of misfire, remote reading of detonators' IDs once detonators are in situation to blast are important for dependable inventory control also for safety features in mining work.

## ▪ Ore Tracking / Tracers

RFID Tracers are first inserted into the Dense Medium Separation (DMS) feed. The tracers track the entire process, from insertion to the outgoing product and reject conveyors. In real-time, the tracer notifies the operator of the DMS performance or how accurately the reject product is separated from the valuable product.

# Applications of RFID in Mining Industries

## ■ Core Samples Tracking

Core samples are small portions of a formation taken from an existing well and used for geologic analysis. The sample is analyzed to determine porosity, permeability, fluid content and geologic age from the site. Core samples reveal the physical and chemical nature of the rock. Core tray to be tagged during discovery cycle – sealed until used. Cores should not be modified during storage.



## ■ Condition Monitoring

For mining companies, as in most manufacturing industries, one of the key performance indicators is asset uptime. Hence, preventing equipment failure becomes crucial. Gathering data and insights on the machine, continuously or periodically, to be able to implement measures before failures occur is known as condition monitoring.

## ■ Tracking of Mobile Assets

To optimize mining assets, RFID solutions can track mobile assets. The data that these sensors and tags provide, allow mining companies to track all mining assets and personnel 24 hours a day. This real-time data and analytics

## ■ General Safety – RTLS / Accident Protection

Managers in mining industry are under pressure to optimize maintenance, workforce, reduce costs, and establish a safe working environment. RTLS can help monitor usage of every equipment, location and movement of employees, and create analytics help improve workflows and safety.

# Anti-Counterfeit and Anti-Tampering

Verifying that goods and materials are authentic. When dealing with counterfeiting and tampering, RFID tags can prevent or identify tampering and protect the tag's data with proper encryption.



# Ore Tracking / Embedding RFID

- All stages of a mining operation are influenced by ore characteristics.
- RFID tags (tracers) placed among the ore flow with it all from the mine through the process, allowing ore characteristics to be correlated with important operating parameters in the mine and processing plant.
- These parameters can then be adjusted and optimized for different ore types to increase profitability.
- Track material through the delivery chain to monitor and optimize product supply management, transport logistics and margin
- With no internal power source RFID tags can remain in stockpiles for extended periods, enduring harsh environments
- HID Global provides design-in RFID technology for ore tracers or any other special application that requires contactless identification



# Maintenance Checks

- Different form factors of on-metal NFC tags used
- Uniquely identify equipment for maintenance checks
- Generate Audit Trail
- Proof of presence / HID Trusted Tag® option
- Pen reader for smallest NFC tags





# Reading RFID Tags in Harsh Environments



- TSL 2166 - up to 9m (30 ft) read range
- IP67 Environmental Sealing
- 1.8m Drop Spec
- 1500 0.5m tumbles at room temperature (3,000 cycles)
- Operating Temperature:  
-10°C to 55°C (14°F to 131°F)



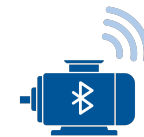
Construction:  
<https://youtu.be/-7tSes3TtBc>

# RFID on site Maintenance

- Computerised maintenance management system for conveyor belts
- SlimFlex tags are used to identify roller assembly location
- Maintenance person walks the conveyor with temperature sensor gun / RFID reader to record temperature of rollers to check for historical variations at each location
- Maintenance alert schedules inspection/replacement during down time
- ROI comes from prevention of damage to belts and unplanned maintenance
- If the loading ship is delayed at the dock it can cost millions



# Condition Monitoring



Monitoring vibrations and temperature of bearings provides an early indication of potential failures and prevent damage of conveyor belts





# Employee authentication at Newmont's polymetallic mine in northeastern Mexico

- Staff members simply tap their Seos credentials to a RAGTAB tablet with an embedded HID OMNIKEY reader
- The Alutel Mobility app displays the worker's photo and data for increased visual verification, and connects with Newmont's access control platform for authentication
- The tablet displays signals to allow or deny site access
- If there is no internet connectivity, the mobile device saves the data collected and verifies once connection has resumed
- Since implementation, the company processes more than 100,000 authentications with HID's smart cards and mobile IDs each month

## Employee authentication challenges in remote areas



hidglobal.com

## Solution



## Benefits

- Fully operational system
- Security at all access points
- Improved company-wide organizations
- Optimal security

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# Identifying Fire Fighter Equipment

- Manufacturer places NFC LogiTag™ into the respirator mask, the air tanks, and other firefighter equipment for automated tracking of maintenance service and life cycle of equipment
- Logi Tag 161 EX and Logi Tag 081 EX with ATEX/IECEX and UL 913 certifications for Hazardous Zones



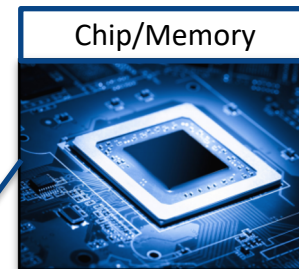
# Fueling Automation



- Implemented an intelligent refueling system for trucks
- The system consists of customer-made Auto Fuel Terminal with RFID authorizing the delivery of the fuel
- Data like fueled quantity, type of product, fleet vehicle/equipment details are stored in the terminal



# Pick the Right Tag for your Application



# Main Characteristics of RFID



	LF (125/134.2 kHz)	HF (13.56 MHz)	UHF (860-960 MHz)	Active Tags (2.45 GHz)
Data transfer rate	↘	→	↗	↗
Memory capacity	↘	↗	→	↗
Operating range	→	→	↗	↗
Anti-collision speed	n/a or ↘	→	↗	↗
Maintenance-free operation	↗	↗	↗	↘
Water/humidity	↗	→	↘	↘
Metal environment	↗	→	↘ or ↗	↘ or ↗



# Conclusion

Tags that are tested in the lab, ensure they last in the field



Hazardous



High Impact



Fire Resistant



Water Resistant



Vibration



Direct Sunlight



Extreme Cold

# THANK YOU

[hidglobal.com/rfid](http://hidglobal.com/rfid)

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