



Dropsafe[®]
Drops Prevention Technology

DROPS PREVENTION

A DROPSAFE HANDBOOK

dropsafe.com

PART ONE:

WHAT ARE DROPS AND HOW DO THEY AFFECT WORKSITE SAFETY?

With the energy sector looking to bolster its approach to safety, operators of workplaces are driving significant improvements in tackling Dropped Objects (Drops). The risks are now better understood, and knowledge of Drops prevention best practice is increasingly taking root.

Drops prevention is not yet ingrained across the board, however. Worksites are prone to drops and may have differing levels of Drops training. HSE personnel and site managers need to be able to apply and incentivise common standards.

Ultimately, a mine site, an offshore rig, or any other workplace, must be equipped with the knowledge – and the tools – to minimise Drops risks and deliver a safer working environment, while reducing long-term expenditure.

This Handbook aims to provide a practical resource for operators within the energy industry, ensuring that everyone is prepared to meet the Drops challenge. The handbook will offer guidance based on real experiences to effectively reduce Drops.

WHAT IS THE FREQUENCY OF DROPS INCIDENTS

A lack of consistent reporting is a serious issue and represents a key stumbling block for effective Drops prevention. Industries such as Oil & Gas do have established bodies such as DROPS (dropsonline.org) to collect incident data. But in other industries, however, there are no industry specific organizations and thus minimal reliable current statistics. Incident reports may not even be shared between facilities of the same company, let alone among the wider industry, so it is key to ensure that companies have adequate measures and solutions in place to tackle Drops.

BETWEEN 2010 TO 2014 IN AUSTRALIA, DROPPED OBJECTS CAUSED

125 FATALITIES

& 15,410 SERIOUS WORKERS COMPENSATION CLAIMS

SOURCE: SAFE WORK AUSTRALIA

WHAT ARE DROPS?

A Drops incident occurs when an item falls from height, causing equipment damage, personnel injury or fatality

Drops incidents fall into one of two categories: Static or Dynamic. Approximately 80% of Drops are Dynamic – the rest Static. Human error is a key factor leading to Dynamic Drops and an important consideration for those responsible for designing Drops prevention programmes.

DYNAMIC DROPS

Objects falling due to applied external force, including those falling from conveyor belts, handheld items such as hammers dropped by personnel, moving equipment or materials being accidentally dropped when being lifted into place.

STATIC DROPS

Fixed objects that fall from height with no external force applied, such as lights or speakers breaking free from their attachment points due to vibration, corrosion, poor maintenance or being incorrectly installed.

WHAT ARE THE IMPACTS OF DROPS

Drops incidents present a fourfold threat to the safety of personnel, the integrity of equipment, the reputation of businesses, and their financial performance. Safety is, and should always be, the first priority for HSE personnel and site managers. As the diagram shows, however, the first three factors combine to create financial losses.

Personnel safety

The clearest and most commonly recognised impact of Drops is the threat to personnel, who may be struck by an object and suffer anything from a minor injury to long-term disability or even death.

Behind every statistic is a person, with loved ones and family. Although equipment can be replaced, the duty of care to protect employees as much as possible is far more important.

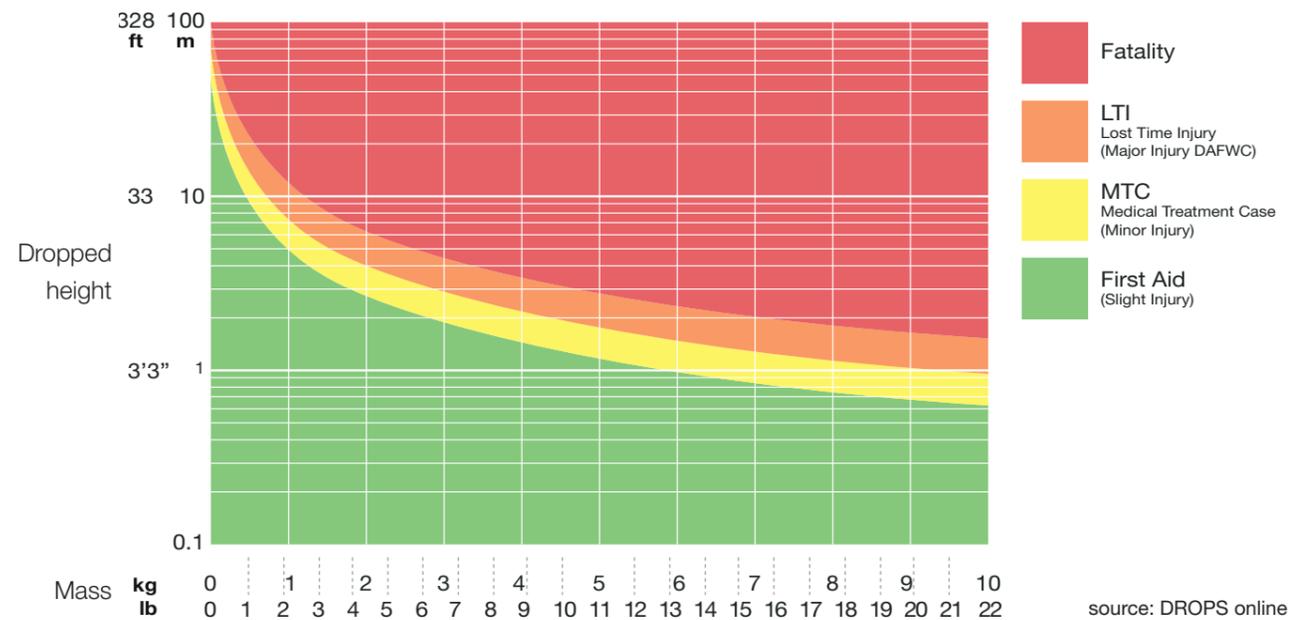
Injuries to personnel also cost facilities financially through working days lost. Furthermore, there are potential financial compensation implications, incident reports

and investigations - both internal and by regulators. Also, as HSE professionals will be well aware, there are legal consequences that go hand-in-hand with injuries and fatalities.

As the DROPS Calculator shows, even relatively light objects can cause fatalities when dropped from height. For example, a 1.5kg wrench striking someone from 10m could present a high potential risk of death.



Figure 1: DROPS calculator



Equipment integrity

Drops can also strike equipment, leading to loss of tools and causing damage to structures.

If a Drops incident causes damage to important equipment, this incurs the cost of replacing damaged assets, but may also lead to a temporary suspension of operations, creating significant challenges and causing further financial losses.

Corporate reputation

While site or facility managers are rightly focused on the day-to-day task of protecting personnel and equipment, Drops incidents can have more far-reaching impacts on companies, particularly when negative attention is drawn towards the operator.

Press coverage is sometimes the only way of uncovering the details of a significant Drops incident. Part of the reluctance to issue comprehensive statistics and provide useful case studies about incidents of falling objects relates to the reputational damage this could do to businesses.

If severe Drops incidents are reported by national media, it reduces trust in the company involved and can affect future business prospects.

Financial risks

Again, financial impacts may be the least of concerns, but the above risks combine to impact the financial standing of a business in different ways – directly or indirectly.

It is difficult to accurately assess the cost to businesses of individual Drops incidents, as operators are reticent to share this information. When the costs identified above in terms of compensation claims, lost time incidents (LTIs), damaged tools and equipment are combined, the result can significantly affect the profitability of a site or facility.

The disruption caused by an enforced inspection during a post-incident investigation can also be a drain on time and resources. The paperwork and reporting process undertaken by HSE managers and operations managers is time spent away from productive work. Should scrutiny of procedures by inspectors lead to a citation, this could mean further reputational damage.

The intangible costs to a business caused by this kind of reputational damage, can exceed all other financial costs. Ultimately, establishing a holistic approach to Drops prevention will give more control over Drops, their incident rates, prevention costs, and the reputation of their company.

PART TWO:

IDENTIFYING THE PRIMARY CAUSES OF DROPPED OBJECTS

Dropped object incidents can occur at any time, for any number of different reasons. On worksites - especially those in the energy industry - the likelihood of a dropped object risk occurring is significantly higher. Any location with a large number of potential hazards means there will inevitably be a greater number of risks that could be realised.

Human factors and unintentional human error plays a huge part, as do other factors, such as vibration or corrosion, and exposure to harsh environmental conditions. Anything from the icy winds of the North

Sea, to the heat of an Australian summer, the tropical storms of South-East Asia or hurricanes in the Gulf of Mexico. All these factors can negatively affect fixtures secured at height.

As dropped objects can be all manner of items, from heavy light fixtures to nuts and bolts, the impact they can have can be equally huge. Knowing why they happen and the main causes is a key element, as only by having this knowledge can avoidance and mitigation strategies be decided upon and put into place.

Of all the reasons that can cause dropped object incidents to come about, the top ten can be identified as the primary causes.

ON AVERAGE, NEARLY

140 PEOPLE

ARE 'STRUCK BY A FALLING OBJECT' EVERY DAY IN THE USA

SOURCE: OSHA

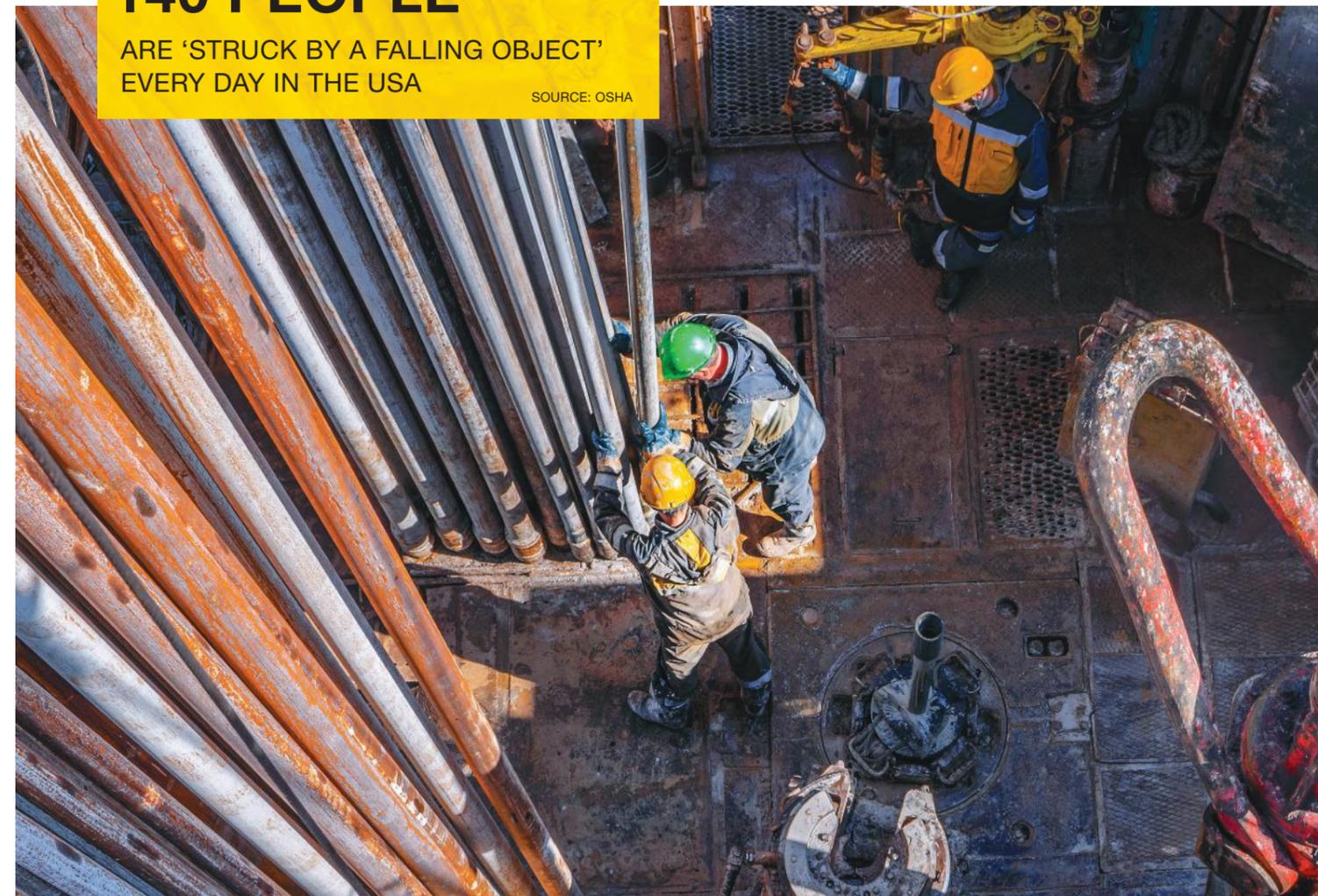


Figure 2: Risk assessment



IMPROPER RISK ASSESSMENT

Risk assessment is a crucial element important to all sectors within the energy industry. Risk assessment tools are used to help prevent major hazards - such as dropped objects - from injuring workers.

The structured process associated with risk assessment helps identify the major hazards and evaluate engineering, management and work processes that can help mitigate or minimise their potential risks.

Principle Risk Management Framework

The probability that something is likely to cause injury - combined together with the potential severity of the injury - is classified as a risk.

Inadequate acknowledgement, understanding and assessment of risks, such as objects falling from height, makes for an unsafe work site. Risks can only be controlled and dealt with if a risk assessment is conducted.

Minimising activity, by its very nature, involves a number of risks and hazards.

Risk assessment and analysis should be a compulsory element across all sectors within the energy industry. Risk assessment enables the establishment of priorities, so as the most dangerous situations can be addressed first. Inadequate risk assessment makes for unsafe

workplaces, which could easily cost in reputation and, if unaddressed, the health, wellbeing and potentially the lives of staff.

A five step guide to risk assessment

1) Identify the hazards

It is important to know the difference between a hazard and a risk. A hazard is something with 'the potential for causing harm'; a risk is 'the likelihood that potential harm being realised'. Hazards can be easily identified, for the most part, by conducting site inspections and speaking with employees.

2) Who might be harmed and how

Once hazards have been identified, evaluate who could be harmed and how that harm might occur.

3) Evaluate risks and decide control measures

After completing steps 1 and 2, the next course of action is to protect those identified in step two, from harm. The hazard(s) can either be completely eliminated, or the risks controlled, making injury unlikely.

4) Record findings

Recording findings is not only a legal requirement in many places but also shows that hazards have been identified, along with a plan to eliminate the risks.

5) Review and update as required

Review your risk assessment frequently and check it regularly. Update it as and when necessary.

HUMAN FACTORS

When you have humans, you will have human error.

'Human factors' do go beyond each individual employee, looking at interrelated elements and behaviors that, through improved procedures and updated cultural practice, can create positive changes to a work site. One of the main things to remember is that everyone in any workplace is 'only human', and as humans are all fallible; accidents can and do happen.

These include:

- errors and unintentional mistakes
- poor judgement or bad decision making
- disregarding procedures

Many of these factors can be prevented or, when not preventable, be rectified before personnel safety becomes an issue. Basic safety training upon the hiring of new employees is a start, yet the evaluation of human factors needs to be an ongoing effort involving all employees. Human factors need to be understood in order for an occupational safety professional to find ways to mitigate risks with 'stopgap' measures, preventing accidents before they occur.

Many other solutions exist to 'close the gap in human error', most of which are more long-term fixes than those labelled 'stopgap'. These include barriers, barricades, guardrailing and toe boards to prevent dropped objects falling from platforms or walking working surfaces. Other solutions as simple as self-locking carabiners significantly reduce the likelihood of human error by preventing the mistake or accident from occurring.

ALMOST HALF OF DROPPED OBJECTS
CAN BE ATTRIBUTED TO
HUMAN FACTORS

SOURCE: NLG

INADEQUATE PROCEDURES

Similarly to improper risk assessments, inadequate procedures often come from, or as a result of, poor planning and no management of change. Management of change is something that needs to be in place in order to identify and control risk that comes from changes that occur within the workplace. Namely those that may create new or previously unidentified areas of risk.

Procedures to prevent risks from occurring in the first instance should also be standard across all work sites. Although often considered to be a waste of time, procedures such as toolbox talks can be the difference between a hazard becoming a risk, and said risk being avoided.

Toolbox talks are informal meetings that focus on safety topics of specific jobs, such as working at height, where objects falling from above can be a significant risk. These talks cover a wide range of workplace hazards and safe work practices, as a way to refresh workers knowledge and exchange information.

Procedures like this can help avoid hazards, making worksites safer overall.





ACCORDING TO THE NATIONAL SAFETY COUNCIL, 1 EMPLOYEE DEATH COSTS

1.4 MILLION USD

SOURCE: NATIONAL SAFETY COUNCIL, INJURY FACTS 2015 ED.

even more the case when it comes to moving objects falling or colliding with a stationary object, causing them to fall.

INSUFFICIENT INSPECTION, REPAIR & MAINTENANCE

Put simply, inadequate inspection, repair and maintenance means ignoring unsafe conditions. Regular inspections and planned maintenance repair schedules can help when identifying corrosion, damages, equipment wear-and-tear and structural weaknesses before they move from becoming a hazard to a dropped object risk.

Maintenance is required frequently in order to keep equipment, machines and the work environment safe. Lack of, or inadequate maintenance, can lead to dangerous and potentially life-threatening situations. Maintenance in itself is a high risk activity, with many of its own hazards, including working alongside a running process and in close contact with machinery. During normal operations, automation tends to significantly reduce the likelihood of human error. During maintenance, however, this is not possible.

In order to limit the amount of actual maintenance work that has to be done, regular inspections need to be correctly undertaken on worksites. In terms of dropped objects, most inspections will be required at height. This also holds its own dangers just like maintenance work, but as long as safety precautions and protocols are followed, inspections can take place safely with limited risks. Fixtures situated at height are not the only inspections that take place – any items that have the potential to pose a dropped object threat should also be thoroughly inspected.

This regular inspection determines whether repair or maintenance is required, and therefore whether the site is safe for work to continue. It is of extreme importance, therefore, that these inspections (and any maintenance or repair that may be required) are adequate to ensure that all personnel on-site can work in an environment that is safe and secure. Keeping a detailed log of inspections is also recommended; this can be made easier and more streamlined using in-built RFID-enabled safety securing solutions.

POOR HOUSEKEEPING

While it may seem like simple day-to-day activity, good housekeeping can positively affect site safety in a big way. Ensuring work sites (no matter their location) and toolkits are kept organised and tidy is an instant improvement when it comes to creating a safer environment. Loose tools and equipment left around pose an unexpected risk to personnel. A great majority of all work accidents are caused during the handling of goods or materials, and people falling, being hit by falling objects, or striking against objects in the workplace.

When good housekeeping practices fall down, and poor housekeeping replaces them, the likelihood of accidents and human error increases. Other risks increase exponentially too. Fire becomes a more prominent risk from oil-soaked rags or spontaneous combustion, for instance.

Perhaps the most important element of maintaining good housekeeping is the ongoing maintenance of buildings, structures, and equipment. If something (be it a fixture at height, a handrailing, or anything else on a worksite or facility) gets broken or damaged, it should be fixed (where possible to do so safely) or replaced immediately. Even if it seems to still be fully functional, continuing to use broken equipment can end up being more detrimental in the long run.

Pre-existing hazards from previous tasks can cause serious damage to personnel, especially because the workers will change and rotate, therefore those who witnessed the damage firsthand may not be the ones who suffer the effects.

A good maintenance programme will make provision for the inspection, lubrication, upkeep and repair of tools, equipment, machines and processes.

COLLISIONS & SNAGGING

Moving equipment using lifting wires can cause snagging and collision. Extra care and caution should be employed when it comes to moving equipment and handling wires. Accidents that cause impacts can also cause objects to fall and generate debris which can, in itself, fall, thus causing further risks.

Collisions and snagging risks fall firmly into the category of a dynamic dropped object hazard. Dynamic dropped objects, as previously mentioned, incorporate any object that falls as a result of applied force. When establishing a drops zone (or 'red zone'), the distance a dropped object can travel is difficult to estimate, even when it's a fixture falling. While it would be expected to fall straight down, other obstructions - or even environmental factors - can cause the drop path to change, potentially causing ricochets. This is

REDUNDANT, NEGLECTED, OR HOMEMADE EQUIPMENT

All equipment that has become redundant, been left and neglected rendering it below adequate standards, or is homemade, should be eliminated immediately.

Homemade tools, tethers, dropped object prevention devices and any other equipment used on-site, serves only to increase risks within the workplace. The equipment has not been certified, tested and, in most cases, is a 'quick fix', temporary solution which has ended up being left in place long-term.

Similarly, damaged tools that have been subjected to a previous fall pose their own dropped object dangers. Their previous impact could cause them to fail or break apart unexpectedly, the broken element becoming a drops risk.

When it comes to drops prevention solutions, it is important to follow the installation instructions, which will have been tested and can be trusted. Using rope instead of proper tool tethers, or cable ties in place of specific attachment components only serve to jeopardize the safety of onsite personnel.

Redundant, neglected, and homemade equipment must not be used under any circumstances as a substitute for proper drops prevention solutions.

DROPPED OBJECTS ARE CONSISTENTLY THE THIRD MOST FREQUENT CAUSE OF FATALITY & SERIOUS INJURY IN THE OIL & GAS SECTOR

SOURCE: DROPS



A 2KG HAMMER DROPPED 5 METRES WILL HAVE AN IMPACT FORCE OF OVER

1 TONNE

SOURCE: NLG

INADEQUATELY STORED TOOLS OR EQUIPMENT

When using tools, especially if it's possible that personnel may be working or walking below, tool lanyards should always be in use. Tethering tools is crucial, as when tools become dropped objects, they can be just as dangerous as larger objects (and often more so, as their projected fall track is far harder to predict). Similarly, loose or handheld items of any kind should also be secured, whether to an individual or some form of tool bag, in order to prevent a dropped object incident occurring.

Handheld tools and power tools; mobile phones and two-way radios; even personal protective equipment (PPE) such as hard hats, are all items that have to be adequately secured (which is just as important as storing equipment).

When not using certain equipment, it is important that it is stored correctly and appropriately. Using a tool bag or kit is a good way of storing tools, both for safety and to prevent losing them. When tools are not stored correctly, they can present trip hazards, can be kicked from walkways to become dropped objects, and cause further issues.

Although considered by many to be 'taking safety to the extreme', it's important to remember how much damage smaller items can cause when they become dropped objects.

FAILED FIXTURES & FITTINGS

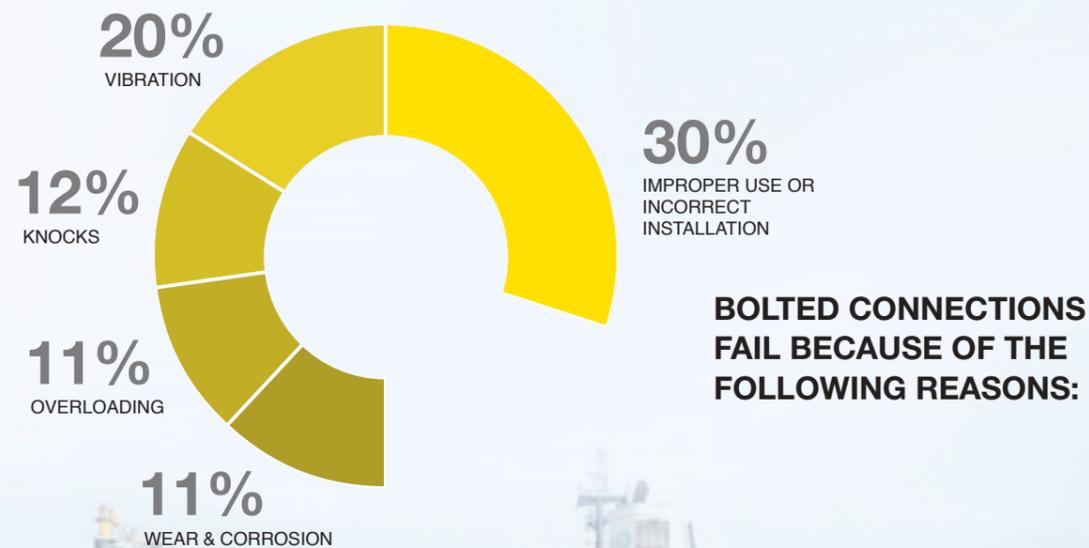
The failure of fixtures and fittings is a key cause of dropped objects. Usually occurring in areas of a worksite where asset inspection is difficult or a geographic location prone to extreme weather conditions, failed fixtures can have fatal consequences.

Galvanic corrosion can cause fittings to corrode. Metals of the same nobility should be combined when used in an environment that can be classed as 'corrosive'. If two dissimilar metals are in contact with one another, the less noble of the two would rust at an accelerated rate. This can occur in areas of high humidity, or when the failure comes into contact with either fresh or salt water: galvanic corrosion.

Bolted connections are also a form of fitting that, if failure was to occur, would cause a potentially fatal dropped object incident. Bolted connections are produced to more than 85 different industrial standards, depending upon sector, operational and maintenance requirements. To achieve a stable bolted connection, the following factors must be evaluated:

- Load design
- Choice of materials (keeping in mind galvanic corrosion and required properties)
- Pre-loading and use of correct torque equipment
- Operational environment and its effect upon integrity

The reality is that no matter the environment or location, failed fixtures and fittings of any type are likely to cause dropped objects. Regular inspection following correct installation makes all the difference.



ENVIRONMENTAL FACTORS

The range of environmental factors that can affect site safety and increase the risks posed by dropped objects is significant. Wind, sea motion, ice, snow, extreme heat, sand storms – the list goes on.

The effects of these extreme conditions impact all sorts of areas, from wide open, fairly exposed areas, to others that are far more centrally located. Harsh weather can compromise stability and the security of equipment. These factors can cause increased corrosion, while putting additional pressure on fixtures located at height, and other structural elements that are exposed to harsh conditions.

What singles environmental factors out from the rest

of this list is that no element of environmental impact can be controlled.

The best way to combat extreme weather is to ensure all equipment is secured with appropriate dropped object prevention solutions; all small or loose items are stored safely; ensure you're not relying on damaged or homemade solutions to prevent drops; make certain that procedures have been followed, all maintenance has been done correctly and inspections have been regular and thorough.

To summarise, by following all the other points in this handbook, and securing your facility or worksite against dropped objects using appropriate safety securing, you can guarantee that your workplace is as safe from drops as possible.



PART THREE: IMPLEMENTING DROPS PREVENTION

When it comes to the reality of preventing Dropped object incidents, it's important to know and understand how and why they occur. Once armed with this knowledge, the task of mitigating risks become significantly easier.

Across multiple industries, especially those in the energy sector, the risk of objects falling from height is exponentially higher due to the kind of work that is being undertaken. This includes regular maintenance, tasks that can be potentially dangerous if not done correctly and influential and unavoidable environmental factors.

Tools and handheld items can easily fall, as can heavier fixtures located at height such as lights, CCTV cameras and all other high-placed equipment. The heavier objects tend to fall most commonly as a result of factors that cannot actively be controlled, such as vibration, corrosion and general wear. Smaller, handheld items fall as result of human error and while this is easier to control, workers don't drop or dislodge tools intentionally. It is therefore paramount that all possible measures are taken across all areas to avoid these incidents which, although very different, can have the same negative and potentially devastating outcomes.

For each type of Drop, the solution is different. The most commonplace and effective solutions to ensure safety best practice throughout your facility are:

- **BARRIER SYSTEMS**

Barrier systems attach to guardrailing and scaffolding, prevent objects falling or being knocked or kicked from walkways or work platforms.

- **SAFETY SECURING NETS & CATCH NETS**

Nets serve to safely secure heavier items located at height, or are installed to catch dropped objects before they can cause harm or damage.

- **TOOL TETHERING**

Tool tethers secure smaller tools and handheld items being used by personnel at height.

Take a look at these solutions in more detail to understand how they differ, and how each have their own specific benefits.



SOLUTION: **BARRIER SYSTEMS**

Here we will take a closer look at one of the core engineered solutions available to mitigate Drops – safety barrier systems. To date, there has not been a detailed guide on the best practice applications of this technology.

DROPS Reliable Securing, which was originally developed for O&G but has now formed the basis for best practice across other industries, states:

“Safety barricades and mesh systems may be applied to reduce potential for items to fall through guard rails. These should be of suitable materials, incorporate appropriate securing features and be installed and maintained in accordance with manufacturer's recommendations.”

Here we will expand on this guidance and help facility and site managers to identify the best barricade systems and show how they can be used most effectively as part of a broader Drops prevention programme.

WHAT IS A DROPS PREVENTION BARRICADE SYSTEM?

Drops prevention barrier systems attach along the inside of guardrailings on stairways, elevated walkways and raised working platforms, covering the gaps to prevent objects from falling through. These objects can include tools, handheld equipment, and loose fixtures or machinery components.

A robust barrier system will also prevent items that have dropped from potentially ricocheting further, by absorbing the force of a falling object. This is particularly important because items that drop can often ultimately strike a worker from unexpected directions.



WHERE SHOULD BARRIERS BE INSTALLED?

There are three main Drops risk areas where installing a barrier system is most effective: walkways, stairways and conveyers.

Walkways & Working Platforms

Elevated walkways and working platforms are high-risk Drops areas, due to large gaps between the guardrailings, and a high likelihood of personnel walking below. Walkways also serve as arteries for personnel, who often carry untethered tools and equipment throughout the facility, creating Drops risks. Barrier systems are a crucial part of Drops prevention, as walkways are often extensive and will be placed over multiple levels.



Stairways

As a point of transition within a facility, a stairway presents a significant Drops risk. Additionally, when personnel are using stairways, they may carry tools or equipment in one hand while using one hand on the handrail, further increasing Drops risks.

Barrier systems should therefore be installed along the guardrailings at the sides of the stairs to prevent objects being dropped through. Where the gaps between steps are large, it is worthwhile to consider installing barriers on the underside of stairs too.

Conveyer & Machine guards

If an object falls from or comes off a conveyerbelt, it can result in significant injury to personnel. Additionally, if a tool is dropped into a turbine or machinery, it may be unsafe to retrieve, or cause damage to critical equipment. A barrier system will help to mitigate these risks.

The correct installation of a barrier system is vital, but what characteristics need to be considered when choosing a barrier?

CASE STUDY: DROPS INCIDENT

HAMMER KICKED FROM WORK BASKET



INCIDENT

A 2.3kg hammer falls 3 metres (10 ft) from an elevated work basket, where it strikes an employee's hard hat. The hammer creates a pinch point between the hard hat and safety glasses thus resulting in a laceration below his left eyebrow.

CIRCUMSTANCES

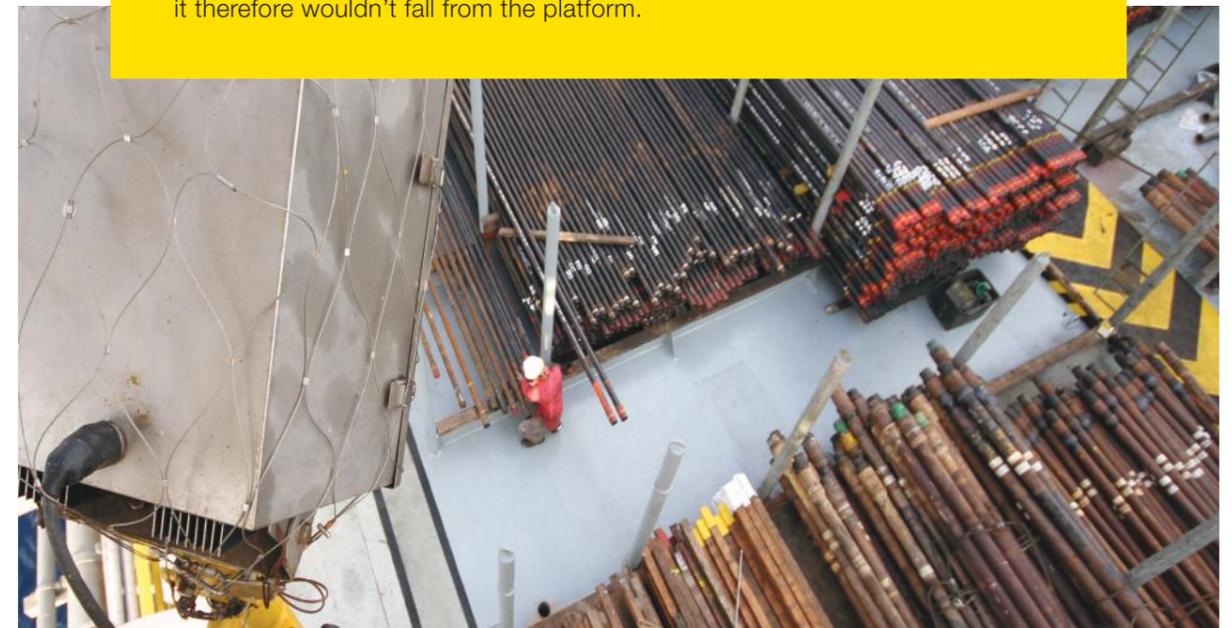
An employee operates a work basket while using a shop hammer. He drops the hammer to the bottom of the work platform and whilst moving about the area to arrange the chain hoist, accidentally kicks the hammer through the railings.

IMPACT

Employees were reminded of the importance of tethering/securing any tools when working overhead, even when working in a work basket. Additionally, the work plan for operating in elevated work platforms must be reviewed to include the importance of keeping the lift basket orderly.

ANALYSIS

This incident could have also been prevented if a barrier system was installed on the work basket. In the case of the hammer being dropped to the floor, if kicked, it therefore wouldn't fall from the platform.



KEY ATTRIBUTES OF A BEST PRACTICE DROPS PREVENTION BARRIER SYSTEM

Commonly adopted barrier solutions include **flexible mesh netting**, **bolted metal fencing** and **modular polymer barriers**. Each of these products can be used effectively in specific circumstances, but not all of them are appropriate for long-term use, depending on the conditions in which they are being deployed.

MODULAR POLYMER BARRIERS

Modular polymer (plastic) fencing systems can be installed on various configurations of handrailing. Polymer barriers are available in a range of specifications, with different levels of resistance to environmental parameters.

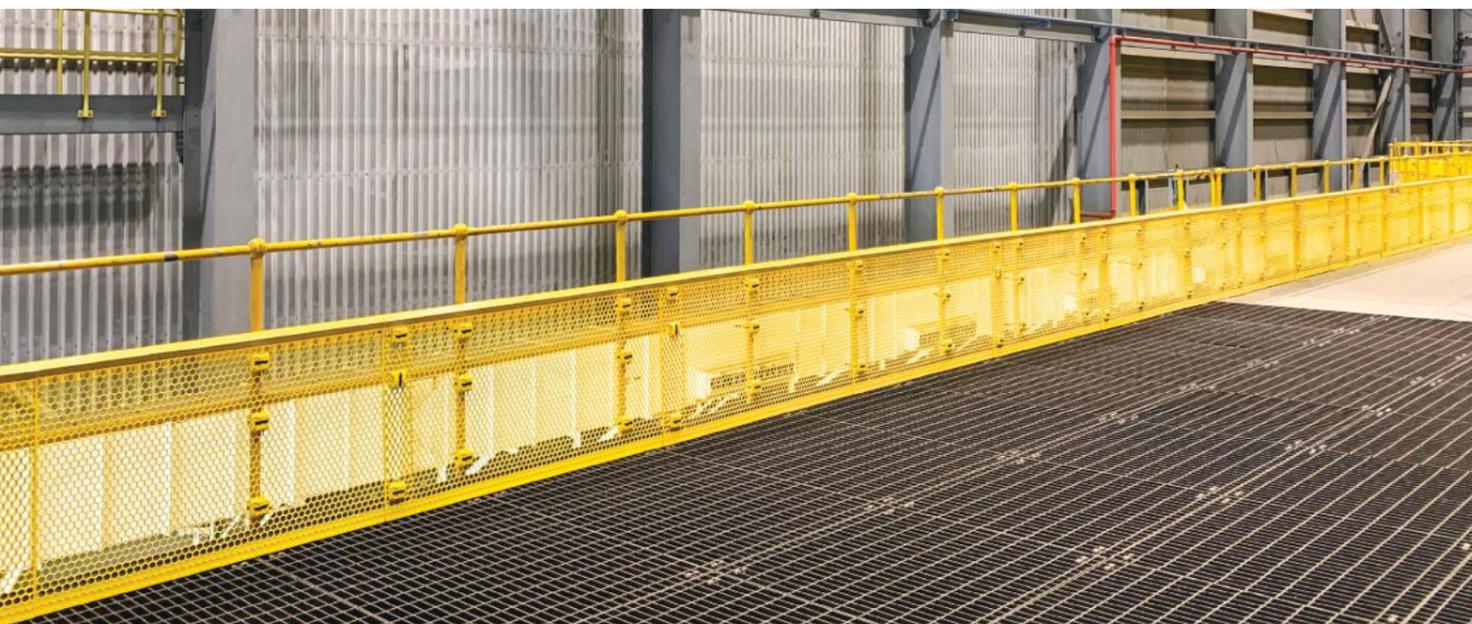
Modular polymer barriers are also intended as a long-term solution, but due to the ease and speed of installation (which requires neither tools nor hot works) can often be uninstalled and redeployed. The quality of polymer systems does need to be considered; weaker options are often not tested, while stronger, more robust options are designed for long periods of use (often 10+ years).

Benefits

- Minimal tools required for installation, with no 'hot works'
- Minimal Drops risks during installation due to limited components
- Easy removal and reinstallation
- High resistance to impacts, heat, wind, and chemicals



Polymer barrier systems are easy to install, maintain and redeploy. With high resistance to impacts and adverse environmental conditions, the solution is a common choice. The upfront cost of certain polymer barrier solutions can, however, be high and depending on region, delivery times may be longer than non-specialist solutions.



METAL FENCING

Metal barricades are typically made of alloys or steel mesh, and can be attached to handrails using specific mounting brackets or welded in place. Some systems are corrosion-resistant, using either galvanised steel or paint, however, they can still require ongoing maintenance. While strong compared to PVC netting, their large aperture can allow smaller objects and debris to fall through.

Metal fencing requires a significant effort and specific skills to install. Some systems use mounting brackets, however, hot works is often required; therefore, the whole process takes longer than any other barrier option. It is, however, intended for a more permanent installation, lasting for a number of years. Metal fencing is hardwearing and very durable.

Benefits

- Long lifespan if maintained effectively
- High impact, heat, and fire resistance rating
- Wide operational temperature range



Metal fencing is one of the most robust solutions, with high impact and heat resistance. When maintained regularly, bolted metal fencing can be used successfully over longer timescales. This maintenance, however, may incur additional labour costs, and its rigid structure makes it difficult to attach in all areas.



Flexible mesh netting is widely used due to its low cost, ease of installation and versatility. Although not ideally suited for use as a long-term solution when compared to more durable or hard-wearing alternatives, flexible mesh netting remains a popular choice.

FLEXIBLE MESH NETTING

Flexible mesh netting is constructed out of connected strands of fibre or other flexible or ductile materials, often PVC, and attached to rails on walkways at height. An ideal solution for short-term, temporary installations. Its flexibility and speedy installation is somewhat overshadowed by its poor durability. Not able to withstand harsh weather conditions or high levels of impact makes PVC a weaker option for a drops prevention barrier when compared to alternatives.

Benefits

- Fast installation requiring limited tools
- Minimal number of attaching components
- Can be attached to any structure regardless of shape
- Readily available with limited procurement time
- Low upfront cost

SOLUTION:
TOOL TETHERING

Tool tethering is a crucial element of preventing dropped objects when working at height. From mine sites to offshore rigs, dropped tools pose a serious risk to personnel and equipment.

It is essential to a systematic approach to working with tools at height when working to prevent the risk posed by dropped objects.

THE RISKS POSED BY DROPPED TOOLS

Hand tools such as hammers, wrenches and washer, or their components, may slip from a technician's grasp and fall through gaps in railings or overhead platforms, leading to a Drops incident.

By taking a proactive approach to preventing dropped tools, facility and site managers have an opportunity to effectively manage the risk of potential harm to their people, assets and businesses' reputation.



A THREE-PRONGED APPROACH TO TACKLING DROPPED TOOLS

Tethering tools involves attaching tools to either the operator using them or in the case of heavier tools, to a fixed anchor point.

1. Tether Points

Used to create a secure, load-rated attachment point on any tool if existing tether points are not already integrated into the tool design.

2. Tool lanyards

Connect the tool to the operator, a tool bag or box, or other anchor point. These come in many forms, material types, and functions, depending on the type and weight of the tool. The connector points on the lanyard also vary, many of which utilise a carabiner or other attachment mechanism.

3. Anchor Point

Anchor points for tool tethers create a secure place to attach a tool lanyard, whether it be on the operator, such as a wristband, belt or hoister, or an immovable object, such as a toolbag or railing.

Tethering

Whilst there are numerous tool tethering solutions available, each should be adequately rated and fit-for-purpose. Quality and performance can be varied, so independently tested and clearly labelled tethering solutions are critical for mitigating the risk of improper use.

While double action carabiners are considered to be suitable for use, triple action, auto locking carabiners offer a significantly higher level of safety.

There are several highly respected resources and best-practice guidelines for tool tethering. These provide a good outline of the necessary requirements when it comes to tool tethering. ANSI/ISEA 121-2018 and

DROPSonline.org are two such resources which look in detail at the importance of tool tethering when working at height.

'Universal' lanyards may present challenges when working in a confined space or where an extended reach may be required to carry out a task. Choosing the correct lanyard in advance is crucial, saving unnecessary trips to swap out items, and thus reducing risk.

When tools are being used, they should be secured to the worksite with wire lanyards. The DROPS Guidelines recommend that 'for tools and equipment \geq 5kg, a minimum 4mm certified wire is recommended.' Best practice tethering solutions will ensure that coil lanyards can only be fitted to tools which are under this weight.





Control measures

Using a static toolkit where tools need to be signed out manually from a central depot is an additional safety barrier enabling better housekeeping and tracking tool usage.

The Guidelines state: “Tools used at height should be logged in and out using a simple Tools Register to ensure that no tools have been left behind.”

Furthermore: “Tools should be stored in such a manner that a simple visual inspection can highlight any discrepancies or omissions in the toolbox inventory, such as 2-colour laser cut foam inserts.”

Contractors

Third-party contractors will often supply their own tools, however, these may not be suitable for working at height.

Facility and site managers should either supply safe tools, or ensure all contractors bring tools and accessories that are suitable and safe.

Tool tethering is a crucial element of a holistic Drops prevention strategy, but should tools be dropped, it is essential to have adequate secondary retention in place.

Training and application

Training personnel in the latest tool tethering best practice is crucial. There are no accredited tooling programmes, so facility and site managers should ensure that robust training is available for their staff.

Applying tool tethering best practice effectively involves:

- Correct use of tool bags and belts
- Control measures
- Managing third-party contractors

Tool bags and belts

When working at height or in confined spaces, best practice is to store tools within a bag, tucked securely inside and tethered separately to attachment points inside it. This ensures that tools cannot swing on their tethers when climbing or working at height, which could cause injury, damage to equipment or a Drops incident.

The DROPS Recommended Guidelines stipulate that:

- “Tools shall be taken aloft in some form of kit bag.”
- “The kit bag shall be attached to the user, and leave both hands free.”
- “Tools are to be attached to the kit bag (not merely put in it).”

SOLUTION:

SAFETY SECURING NETS & CATCH NETS

In the energy industry, one of the most common types of dropped objects are also one of the most dangerous. Fixtures or larger items falling from height after coming loose are heavier than smaller handheld objects and therefore fall with much more force. They can also fall a significant distance depending on the height at which they were situated and are completely unpredictable. As they are placed at height, that makes inspection more difficult. Secondary securing is, therefore, the best, most effective, and simplest way to prevent damage from these objects should they fall.

Safety securing is a method of enclosing and tethering the fixtures located at height, minimising or mitigating incident. Secondary securing can be implemented by a number of different products, some of which are more effective at preventing dropped objects than others.

Securing cables can be used to add an extra layer of security, as can safety slings. These are not the best solutions, however. Dropped objects occur due to failure of the main attaching method of the fixture located at height, whether it's a light, CCTV camera or another item. The dynamic shock load that the safety securing

solution has to endure, therefore, is very high. This is why securing cables and safety slings are less suitable solutions for medium to heavy fixtures.

THE HIGHER STANDARD

The most common and most highly regarded secondary securing device option is the net. Secondary securing nets completely cover and secure fixtures, together with the mounting brackets. The construction of the net is better for absorbing the dynamic load than a sling. The other benefit is that the net contains all parts, also preventing any components of the fixtures from becoming drops.

While fixtures at height do not fall as frequently as tools, or smaller handheld items (as human error is less of a factor), if and when they do fall, the repercussions can cost a site or facility its reputation. Far more than this, however, it could also cost the significantly higher price of the life of a colleague.

Don't take the chance. Use safety securing devices to protect your people.



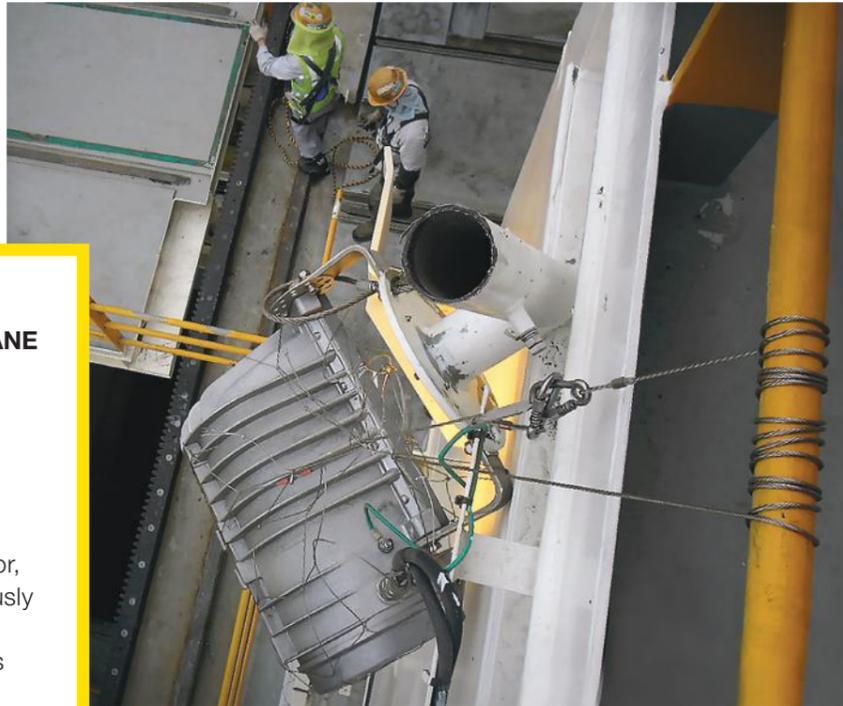
CASE STUDY: DROPS INCIDENT

LIGHT SUPPORT FAILURE

NET PREVENTS A POTENTIALLY SERIOUS INCIDENT DURING CRANE OPERATIONS.

WHAT HAPPENED?

During lifting operations on a drill ship the load unexpectedly swung hitting a floodlight above the drill floor, breaking the light support. A previously installed net securely retained the light, preventing a potentially serious incident.



CASE STUDY: DROPS INCIDENT

BROKEN MOUNTING BRACKET

NET RETAINS A DOWN LIGHT THAT BROKE AWAY FROM ITS MOUNTING BRACKET, PREVENTING A POTENTIALLY SERIOUS INCIDENT.

WHAT HAPPENED?

During maintenance, an electrician found that one of the explosion proof lights had come away from its mounting bracket. Jarring operations were conducted the previous day which may have caused the mounting bracket failure. The light had been installed with a net, which contained and tethered the fixture, preventing a potentially serious incident.

EMPLOYING A SITE-WIDE SAFETY STANDARD

Specific dropped object solutions, such as safety securing netting and barrier systems, work to elevate the level of safety on a site. These additions work with the existing structure to increase dropped object best practice, making any worksite a safer environment for personnel. Many workplaces do have their own 'built-in' safety elements. These can be enhanced by employing drops solutions, yet can often serve to provide a certain level of safety, albeit less substantial.

It is critical, however, to make sure that a site's 'first level' of safety (such as toe boards and floor grating) can aid in preventing drops, and also comply with safety best practice. If not, they could easily pose more hazards than they prevent.

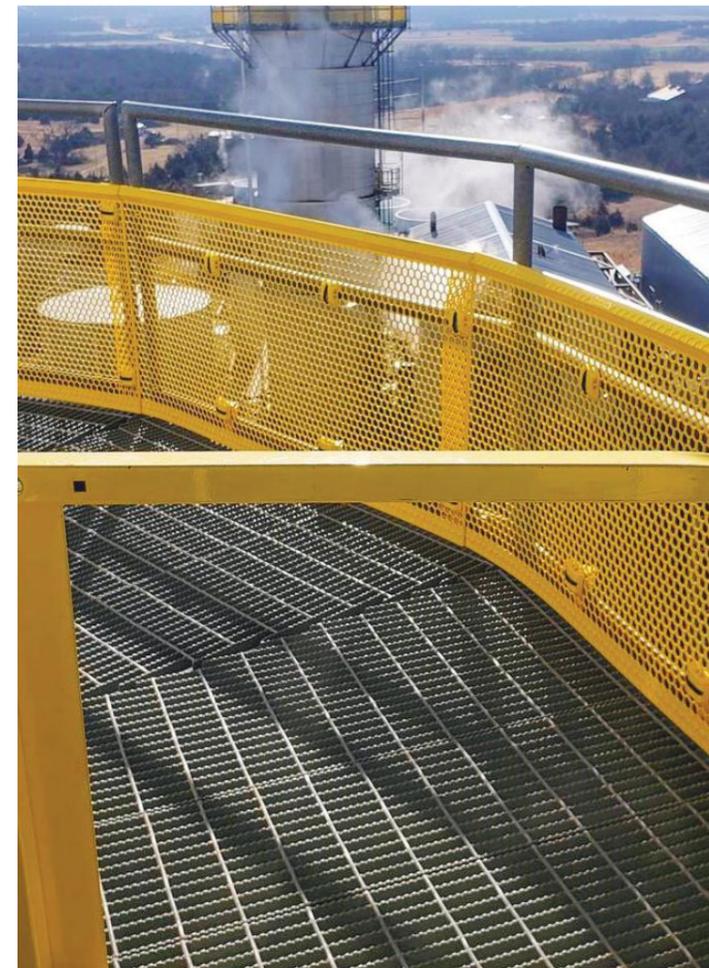
GRATING, HATCHES & ACCESS PANELS

Most worksites do have minimal safety which can, if not prevent, play a part in minimising the negative outcomes caused by objects falling from height.

Grating and hatches especially can be subject to significant levels of vibration, not to mention environmental factors, which could cause integrity failures and, in turn, dropped objects. It is important to ensure all grating is properly secured.

Best Practice

- Grating should be adequately fixed to underlying structures with fastenings that do not come loose as a result of vibration or loading.
 - Bolts and fastening clips should consist of as few parts as possible to minimise the drops risks.
 - Grating openings should not exceed 1,500mm²
- Hatches and access panels also present dropped object hazards, due to improper use, inadequate fixings and lack of inspection, maintenance and general awareness.



SIGNAGE

Adequate signage is one of the most important components of a safe worksite, and can drastically reduce human error. Signage should, ideally, be directly painted onto the structure (and clearly stenciled to ensure legibility). When this is not possible, signage should be appropriately fastened, ensuring the correct primary fixings are used.

Best Practice

- Signs should be secured within a suitable frame or bolted to a mount.
- Where the underlying material permits, sign frames should be attached using through bolts.
- Identification labels or stickers should be secured with steel tape.



PIPING & EQUIPMENT FEEDTHROUGHS

Dropped Objects can often occur at piping cable or equipment feedthrough points when covers or barricades are missing. It is important to be aware of these areas, as they can not only cause objects to potentially fall on personnel, but could damage expensive equipment, consequentially leading to further technical issues.

Best Practice

- Equipment feedthroughs in decks and grating should be covered as much as possible.
- Canvas or cladding material can be used to block holes or gaps.
- It is recommended to use high visibility and rigid covers to make personnel aware of the hazard.

TOE BOARDS

Incorrectly installed toe boards can cause significant hazards that could lead to dropped objects. Often the gap between the deck and the bottom of the toe board exceeds requirements, making it more likely for dropped objects to occur by accidentally kicking or dropping objects on walkways or stairs.

Best Practice

- Platforms and walkways should all have toe boards at least 100mm high.
- On stairways, each step should have a toe board at least 50mm high.
- The gap between the bottom of the toe board and the grating should not exceed 10mm (and is recommended to be flush to minimize the risk as much as possible).

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