IChemE

IChemE Safety Centre Guidance

Lead Process Safety Metrics

Supplementary guide – Permit to Work

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IChemE Safety Centre

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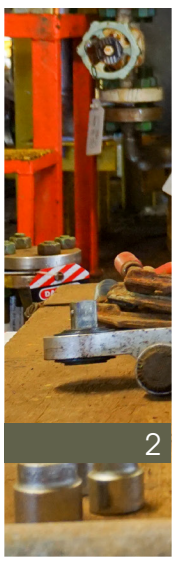

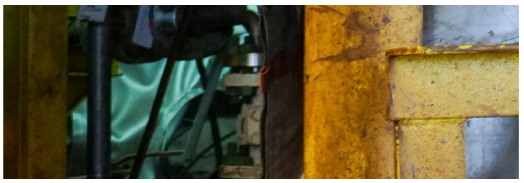

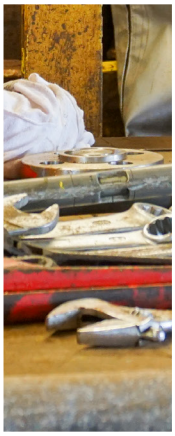

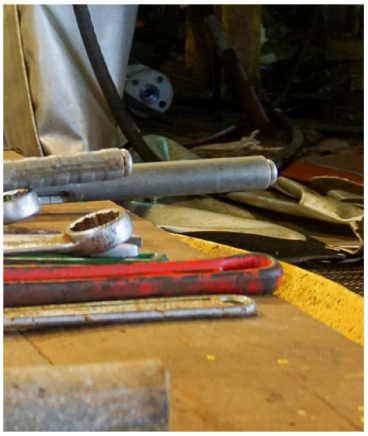

Preface

This document is a supplement to the ISC Guidance Document *Lead Process Safety Metrics – selecting tracking and learning 2015*. This guidance note is intended to provide context for the Lead Metric 'Permit to work checks performed to plan' and 'Permit to work non-conformance' and expand on those metrics. This guidance should be used to help identify suitable performance metrics for your system.

This is the second in a series of guidance documents that will focus on providing more clarity on the type of failures/events to be included in your metrics and will also aid in the goal of capturing similar data across companies and across industries. This will allow for benchmarking and identification of good practice for us to learn from. As acknowledged by the US Chemical Safety and Hazard Investigation Board, it is important that we focus on lead metrics since the focus on lagging metrics is not a good measure or statistically significant for most companies.

Acknowledgements

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- Snowy Hydro – Jim Irvine
- Unilever – Liz Hallifax

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Disclaimer

Definitions and terminology

Definition

A Permit To Work (PTW) system is a formal recorded process used to control work which has been identified as being potentially hazardous. It is also a means of communication between site/installation management, plant supervisors and operators and those who carry out the hazardous work. Its purpose is to ensure that the steps that need to be taken to control risks during critical non-routine or high-risk activities are in place.

Isolation management systems are often used in parallel to a PTW system.

Care must be taken to ensure hazards and risks and the PTW System are not devalued with writing permits unnecessarily.

Terminology used throughout the document are defined in the table below:

Cancel	Documented completion step after surrender.
JHA/JSEA	Job Hazard Analysis/Job Safety Environmental Analysis – documented risk assessment tool.
Lock box/lock out box	Lockable box that contains keys to padlocks placed on isolations.
Permit board	Lockable board used to secure PTW Documentation and lock box/lock out box keys.
Permit to work	A document authorising work activity to be carried out in accordance with the requirements of the PTW system.
Re-issue	Documented notification advising that the PTW has been re-issued to a permit acceptor.
SIMOPS	Simultaneous operations.
Surrender	Documented notification advising that a PTW is no longer required.
Suspend	Documented notification advising that the PTW is temporarily suspended.
Suspended permit	A permit that has been issued at least once where the work activity is not yet complete, and the permit is not active. No work must be undertaken until the suspended permit is revalidated (reissued).
SWMS	Safe Work Method Statement – documented detail of work steps and risks.
Transfer	Documented notification advising that there has been a change in the permit acceptor.
Validity	The time period that a permit remains active once it has been issued and/or revalidated eg permits for high-risk activities may only be issued/revalidated for either up to 12 hours or the end of the current shift.
Verification	The act of independently second checking a document or isolation for suitability and/or completeness.
Viability	Refers to a permit that remains available for revalidation. No change to work scope/hazards etc.

How to use this guidance

This guidance helps to identify suitable performance metrics relating to PTW for an organisation.

These metrics have been tested and used in different industries and have been found to provide value and input into decision making.

Recommended steps on how to implement this guidance:

1. Determine the scope for implementation
   a. are the metrics to be applied across an entire organisation or an individual facility?

2. Map your current leading metrics to the list in Table 1
   a. you may find you are already recording some of these metrics, or very similar ones.

3. Determine any gaps between your current metrics and the metrics outlined in Table 1.

4. Where gaps are identified, determine if you have other metrics to cover them
   a. where you have metrics covering the gaps, and they are useful, continue to record them.
   b. if the metrics covering the gaps are not useful, consider adopting the metrics in this guidance.
   c. ensure that you have a comprehensive picture of the health of your barriers with the metrics that you are recording.

5. Develop an action plan to address the gaps identified
   a. review the implementation section of each metric to see how challenges can be overcome.

Scope of the document

This document aims to define the key elements of a PTW and suggest metrics that can be used to help monitor the performance of your PTW system.

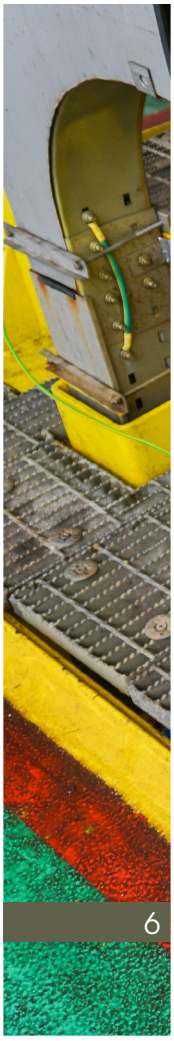
The document sets out:

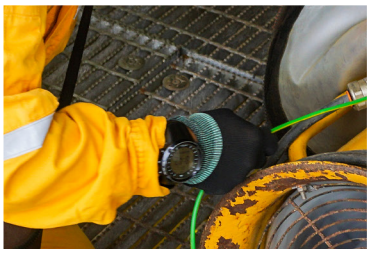
- **general phases in the lifecycle of a PTW, and identifies potential metrics for each phase;**
- **typical elements of a PTW but is not intended to provide a model for development of a PTW system.**

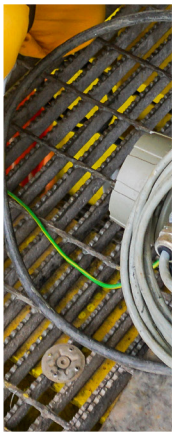
Please note, not all PTW systems are the same, and so the elements are generalised. The reason why elements are defined is not to help build a PTW system, but to show what the critical elements are and what they are trying to achieve in order to show the link to metrics.

Suggested metrics may need to be adjusted for your needs. The metrics suggested should be considered for ease of collection and analysis, if an electronic PTW system is not used; some may be difficult to process and become burdensome.

This document refers to isolations, however, be aware that different industries may use different isolation standards; this document does not look to set out isolation standards.







Key elements of a PTW system

The following provides the key elements that fit within the lifecycle of a PTW system:

- scope
  - it needs to be clear on what is included and what is excluded from the company specific PTW system;
- approved deviation process
  - the system should detail what is the deviation process and what is the escalation process if a deviation is required;
- types of permits
  - definition and purpose of permit types (see examples in Appendix 3);
- permit lifecycle (see Figure 1)
  - may include some or all the examples below:
    - request
    - plan and prepare
    - implement isolations and controls
    - review and verify
    - SIMOPS and conflict identifications
    - issue and accept
    - suspend/re-issue/transfer (if required)
    - surrender and cancel
- roles (see examples in Appendix 1)
  - accountabilities/responsibilities
  - authorisation level
  - role expectations
- hazard and control identification
  - JSEA/JHA/SWMS
  - risk assessment
- work authorisation and monitoring
  - permit issuance requirements
  - monitoring of active permit expectations/requirements
  - validity/viability of permit
  - management of change
- isolations (see examples in Appendix 4)
  - requirements
  - standard of isolation
  - proving of isolations
  - verification requirements
  - securing isolations/maintaining isolation integrity
- assurance
  - auditing procedure scope
  - frequency
  - sample size
- training and competence
  - training PTW role matrix
  - minimum refresher frequency
  - assessment/competency/authorisation

The PTW lifecycle

Not all PTW systems are the same. This simplified PTW lifecycle is intended to provide typical phases, which illustrate how metrics can be used to monitor the ongoing effectiveness of the system.

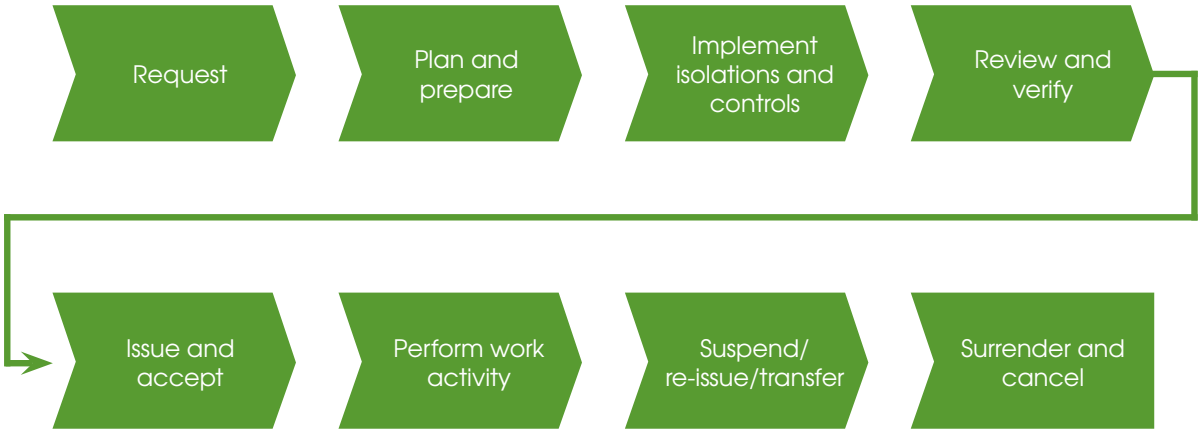
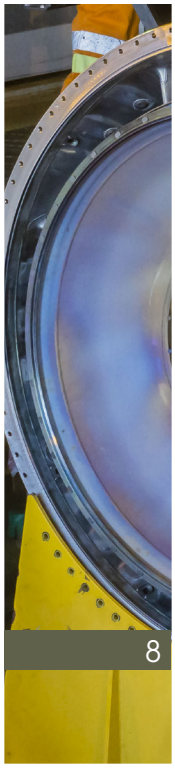
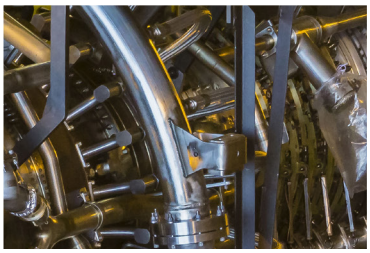
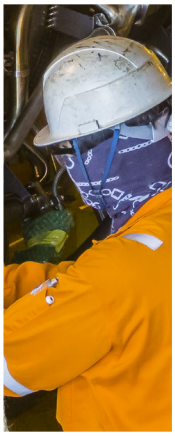


Figure 1 – Simplified PTW lifecycle.







The purpose of metrics

Metrics are performance indicators designed to show progress toward an intended result. Leading metrics are a form of active monitoring focused on a few critical risk control systems to ensure their continued effectiveness. They require a routine systematic check that key actions or activities are undertaken as intended. Metrics can be considered as measures of process or inputs essential to deliver the desired safety outcome.

Note: It can often be found that key performance indicators commonly used in the industry are really checklists for auditing the quality of the permit as opposed to checking the effectiveness of the system.

For example:

- **audit – the structured process of collecting independent information on how well the safety management system is performing;**
- **measurement, monitoring, and checks – the collection of information about implementation and effectiveness of plans and standards.**

Metrics should also be used to look for trends in data over both long and short time periods and to compare year on year data. They should be reviewed by management at regular intervals.

Suggested metrics

This section explains the purpose of each phase in the PTW lifecycle, highlighting critical aspects in terms of risk management. The following table provides metrics that could be used against each of the PTW lifecycle phases to provide insights into overarching system performance.

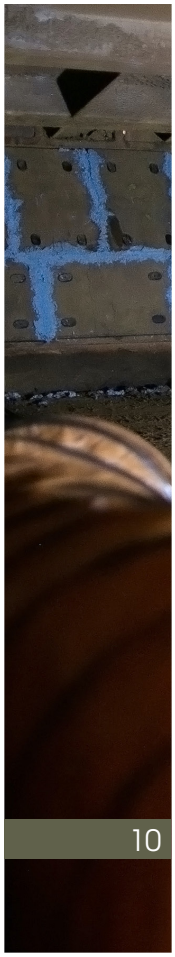
Even though the metrics are aligned to the part of the lifecycle that they are measuring performance of, the data to do that may not become available until a later stage.

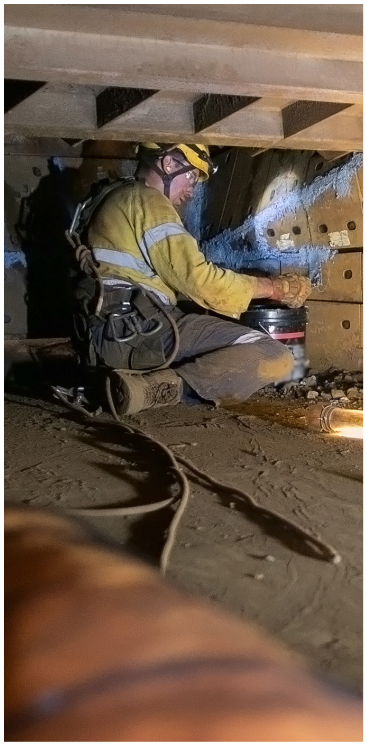
The number of permits generated gives an overall view of the amount of work being undertaken.

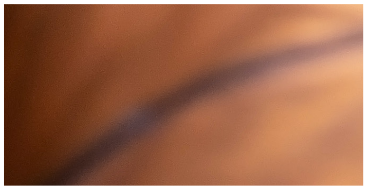
The time spent on permits can indicate how thoroughly these are being completed or not.

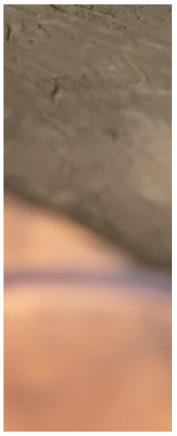
If there is a dramatic negative change in a metric performance this can indicate stress on the system and those involved.

Note: Some of these metrics will be more applicable to electronic than paper-based systems.









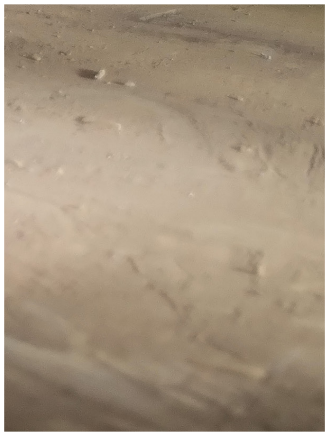


Table 1: Suggested metrics

Lifecycle phase	Purpose	Critical aspects	Relevant metrics
Request	This first step allows the person requesting work to detail the equipment to be worked on and the activity to be performed	■ recognising where a permit is required ■ filling out request form with sufficient information to allow assessment ■ handing form to nominated person who can grant request ■ request submitted with sufficient time for review and approval ■ equipment description is clearly recorded ■ scope of task is clearly defined	■ number/percentage of requests accepted ■ number/percentage of forms denied due to incorrect or insufficient details ■ number/percentage of requests submitted with adequate notification time ■ number/percentage planned vs unplanned
Plan and prepare	This step allows all the risks (including SIMOPs and conflict potential) to be considered and everyone involved or affected by the permit to be made aware of these	■ a specific risk assessment, JHA/JSEA and/or SWMS is made available ■ appropriate controls are identified ■ required isolations are identified and agreed ■ permit conditions, warnings and instructions are captured ■ task discussed by nominated person, person receiving permit and all others involved	■ number/percentage of permits issued where the hazards, risks and control measures (including isolations) were adequately specified ■ number/percentage of high-risk activities by category of risk (eg working in height, hot work etc) ■ number/percentage of work activities relying on third party management standards (eg risk assessment, JHA/JSEA and/or SWMS etc)
Implement isolations and controls	This step ensures all equipment is made safe for work to be undertaken on or near equipment	■ isolations are planned correctly ■ work is scoped correctly ■ all hazards are identified and controlled	■ number/percentage of isolation amendments ■ number/percentage of deviation to isolation standards (eg single valve used instead of double block and bleed)
Review and verify	This step allows the PTW to be reviewed by appropriate roles/authority level to ensure the correct measures have been considered and taken	■ PTW generated and reviewed to ensure it contains all necessary information ■ PTW is clear and legible	■ number/percentage of amendments required following review

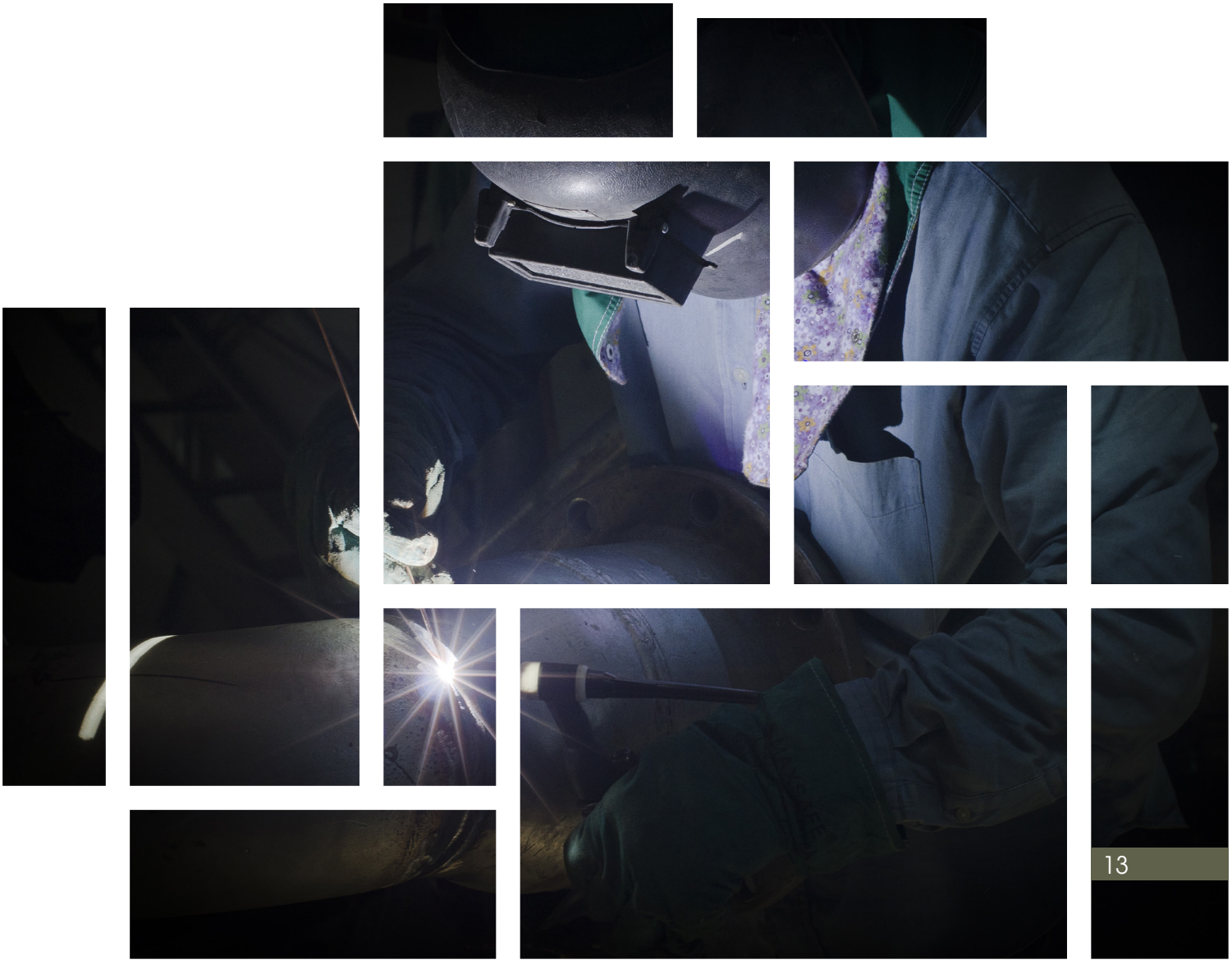
Lifecycle phase	Purpose	Critical aspects	Relevant metrics
Issue and accept	This step allows for the permit to be issued to the permit acceptor/holder	■ appropriate personnel with appropriate competence involved ■ PTW formally issued and accepted by respective parties ■ if applicable, signed copies are distributed	■ number/percentage of permits issued on the day planned ■ number/percentage of issued vs unused permits ■ number/percentage of permits issued with deviations from the established requirements (eg last minute changes etc)
Perform work activity	This step ensures the work is being carried out according to the PTW	■ person supervising work responsible for ensuring PTW complied with ■ site supervisor arranges periodic inspections of work	■ number of inspections/audits monthly/annually as a percentage of total permits ■ number of permit non-conformances monthly/annually as a percentage of total permits ■ number of incidents/near misses occurred whilst working under a permit
Suspend/re-issue/transfer	This step is necessary if the work is not completed within a shift or there is a change of acceptor during the work	■ document suspended/re-issued or transferred ■ new time of expiry added ■ safety implications of inactive job are assessed ■ management of change within the job	■ number/percentage of permits requested to be suspended/re-issued/transferred ■ number/percentage of permits not correctly suspended/re-issued/transferred
Surrender and cancel	This step ensures that the work has been completed fully and safely with all equipment returned back to safe working conditions; when the permit is cancelled it is no longer valid and a new one must be issued for further works	■ permit signed off by acceptor and returned to relevant authorised person ■ authorised person coordinates with acceptor to ensure satisfactory and safe work completion ■ authorised person signs off permit to ensure fully cancelled	■ number/percentage of works finished unsatisfactorily ■ number/percentage of works finished and left unsafe ■ number/percentage of permits left open for longer than x days ■ number/percentage of permits not correctly cancelled

Appendix 1: Typical roles and responsibilities within permit to work systems

Roles and responsibilities should include clear identification of who may authorise particular jobs (and any limits to their authority) and who is responsible for specifying the necessary precautions.

Examples of typical roles and responsibilities/accountabilities are shown below:

Example role title	Example responsibility
Work party member	Works under permit acceptor/holder
Permit applicant/requester	Develops and submits permit application
Permit acceptor/holder	Accepts/holds an active permit
Permit authorised person/senior authorised person/safety controller/area operator	Prepares, reviews/assesses, verifies, issues, cancels permits
Isolation authorised person	Isolates and de-Isolates/restores equipment
Site accountable person/site manager	Accountable for the implementation and compliance for a system

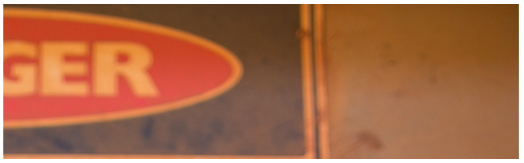


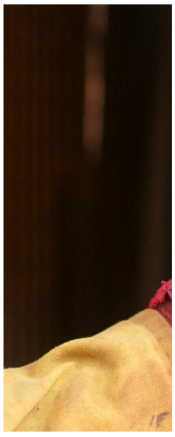
Appendix 2: Typical permit contents

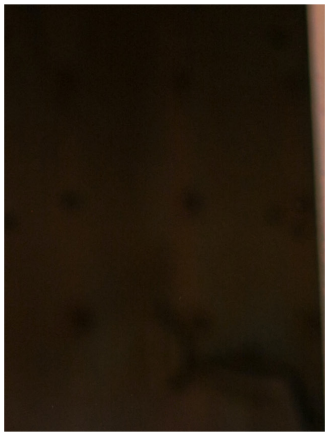
The permit typically contains at least the following information:

- permit type
- location/equipment-scope of work, scope of activities covered by the permit
- hazards and reference to existing risk assessments
- control measures to eliminate or mitigate risks
- permit conditions/instructions/warnings
- isolations or refer to other isolation elements/documents
- means to record permit issue/accept/transfer/suspend/reissue/surrender/cancel
- cross reference to other associated work permits or simultaneous operations

Note: A permit request should include technical documentation used to support the risk assessment and/or to provide guidance in the execution of the task (P&IDs, SOPs, vendor manuals, drawings, etc).





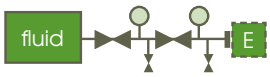
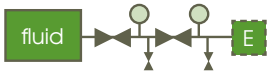
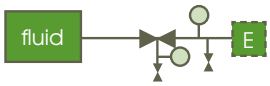
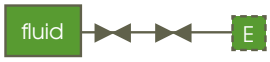


Appendix 3: Types of permits typically included in the PTW system

Lifecycle phase	Purpose	Critical aspects
Work permit	Work requiring written authority	■ A work permit is used to provide authorisation to carry out work. Often referred to as cold work permit in oil and gas and chemical industries
Test permit	Where an isolation may have to be varied as part of the work scope, for example performing a DOR (Direction of Rotation) test on a motor	■ Test permit is used to provide authorisation to carry out testing. This usually involves an alteration to the isolation(s) in order to enable equipment to be operated. No work is to be carried out under a test permit
Lift permit	Work involving complex or critical lifts	■ A documented instruction for safely managing complex/critical lifts, such as those approaching the Safe Working Load (SWL), using multiple cranes, lifting personnel, or where the load is not visible to the crane operator. Load can impact/cause loss of containment event
High voltage permit	Work on equipment with a nominal voltage exceeding 1000 Volts AC or exceeding 1500 Volts DC	■ A documented instruction to ensure all elements of a safe system of work are in place before people are allowed to access high voltage lines and apparatus. It also provides a means for recording the working earth schedule.
Hot work permit	Work involving the use of any potential ignition sources such as arc, flame, sparks, surface temperature or electrical discharge near to gas and air mixtures, vapours or other flammable or combustible material	■ A documented instruction to ensure all elements of a safe system of work are in place before hot work can commence. It also provides a means for recording: • potential ignition sources • potential fuel sources • hot work precautions taken • other specific precautions taken
Confined space entry permit	Work being performed in an enclosed or partially enclosed space that is not intended or designed primarily for human occupancy	■ A documented instruction to ensure all elements of a safe system of work are in place before people can enter the confined space. It also provides a means for recording: • standby person • persons entering a confined space • atmospheric testing results
Excavation and penetration permit	Work involving penetration of the ground surface or through a structure (wall, roof or ceiling) where it is not possible to positively identify potential hazards or energy sources	■ A documented instruction to ensure all elements of a safe system of work are in place before excavation or penetration work can commence. It also provides a means for recording: • excavation/penetration technique • additional safety/environmental controls and precautions • backfill requirements

Appendix 4: Example of isolation standards

The most common mechanical isolation standards are shown below:

Category	Features	Method	Illustrative example
Positive isolation	Complete separation of the plant/ equipment to be worked on from other parts of the system.	Physical disconnection (eg spool removal).	
	Valved isolation of an appropriate standard is required during the installation of positive isolation.	Double block, bleed and spade.	
		Single block, bleed and spade.	
Proved isolation	Valved isolation. Effectiveness of valve closure(s) can be confirmed via vent/ bleed points before intrusive work commences.	Double block and bleed (DBB).	
	Within this isolation category the level of mechanical security is greatest for DBB and lowest for SBB.	Double seals in a single valve body with a bleed in between.	
	As a general rule. SBB should not be used with hazardous substances.	Single block and bleed (SBB)	
Non-proved isolation	Valved isolation. No provision to confirm effectiveness of valve closure prior to breaking into system.	Double valve.	
	Where possible, double valve isolation should be used rather than single valve.	Single valve.	

Key

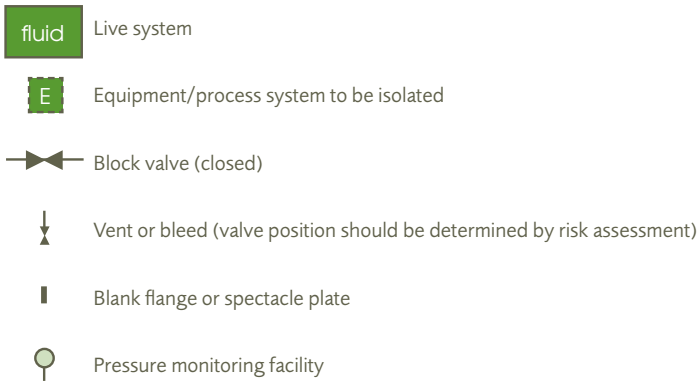


Diagram 1 – from HSG 253 The safe isolation of plant and equipment (UK HSE, 2006)

For electrical isolations:

- positive isolation
  - requires physically disconnecting or removing the current source from the circuit upstream of the work location;
- proved isolation
  - requires physically operating a switch in the power circuit to remove power, followed by a test procedure to ensure that the switching has been effective.

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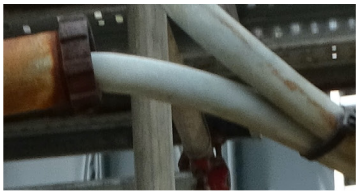

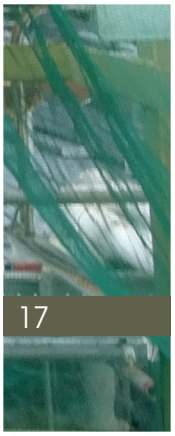

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