GUIDELINES FOR

PREPARING PROCESS EQUIPMENT FOR MAINTENANCE AND RETURN TO SERVICE

CCPS
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Guidelines For Preparing Process Equipment For Maintenance And Return To Service

CENTER FOR CHEMICAL PROCESS SAFETY

of the

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ACRONYMS AND ABBREVIATIONS

ACOP	Approved Codes of Practice
ACC	American Chemistry Council
AIChE	American Institute of Chemical Engineers
BLEVE	Boiling Liquid Expanding Vapor Explosion
CCPS	Center for Chemical Process Safety
CFR	Code of Federal Regulations
CISCC	Chloride Induced Stress Corrosion Cracking
COD	Consequence of Deviation
COMAH	Control of Major Accident Hazards
CSB	Chemical Safety Board (US)
CSTR	Continuously Stirred Tank Reactor
DB&B	Double Block and Bleed
DCS	Distributed Control System
DSEAR	Dangerous Substances and Explosive Atmospheres Regulations
EA	Environment Agency
EIP	Energy Isolation Plan
EPA	Environmental Protection Agency
FCC	Fluid Catalytic Cracking
FMEA	Failure Mode and Effects Analysis
FMECA	Failure Modes, Effect and Criticality Analysis
GMP	Good Management Practice
HASAWA	Health and Safety at Work Act
HAZOP	Hazard and Operability Study
HDPE	High Density Polyethylene
HIRA	Hazard Identification and Risk Analysis
HRSG	Heat Recovery Steam Generator
HSE	Health and Safety Executive
HSG	Health and Safety Guidance
ICI	Imperial Chemical Industries
ILO	International Labor Office
IOGP	International Association of Oil and Gas Producers
ISO	International Organization for Standardization
ITPM	Inspection, Testing, and Preventive Maintenance
JSA	Job Safety Analysis
KO	Knock Out [drum]
LEL	Lower Explosive Limit

LNG	Liquefied Natural Gas
LOPA	Layer of Protection Analysis
LOPC	Loss of Primary Containment
LOTO	Lock-Out Tag-Out
LPG	Liquefied Petroleum Gas
MAWP	Maximum Allowable Working Pressure
MIC	Microbiological Introduced Corrosion
MOC	Management of Change
NDE	Non-Destructive Examination
NFPA	National Fire Protection Association
NORM	Naturally Occurring Radioactive Material
NRC	Nuclear Regulatory Commission
OECD	Organization for Economic Cooperation and Development
OEM	Original Equipment Manufacturer
ONR	Office for Nuclear Radiation
OSHA	Occupational Safety and Health Administration
P&IDs	Piping & Instrumentation Diagrams
PEI	Positive Equipment Identification
PFD	Process Flow Diagram
PHA	Process Hazard Analysis
PIS	Pyrophoric Iron Sulfide
POSM	Propylene Oxide/Styrene Monomer
PPE	Personal Protective Equipment
PRD	Pressure Relief Devices
PSE	Process Safety Event
PSI	Process Safety Information
PSM	Process Safety Management
PSSR	Pre-Startup Safety Review
PSV	Pressure Safety Valve
PTW	Permit to Work
RBPS	Risk Based Process Safety
RMP	Risk Management Program
SCBA	Self-Contained Breathing Apparatus
SCTA	Safety Critical Task Analysis
SDS	Safety Data Sheets
SEPA	Scottish Environment Protection Agency
SIMOPS	Simultaneous Operations
SME	Subject Matter Expert
SOL	Safe Operating Limit
SOP	Standard Operation Procedure
SSOW	Safe Systems of Work

SWA	Stop Work Authority
TIH	Toxic Inhalation Hazard
TLV	Threshold Limit Values
UNEP	United Nations Environment Programme
UV	Ultraviolet
VRU	Vapor Recovery Unit
WTL	Walk the Line

GLOSSARY

Term	Definition
Air-gapping	Removal of pipe or spool piece between process and work area (Physical disconnection)
Barrier	A control measure or grouping of control elements that on its own can prevent a threat developing into a top event (prevention barrier) or can mitigate the consequences of a top event once it has occurred (mitigation barrier). A barrier must be effective, independent, and auditable (CCPS 2019). For the subject matter of this book, this may include a closed valve, a blinded or blanked line, electrical lock-out or a safety procedure relating to a check before a line is opened.
Blank Flange or Blanking Plate	See Blind Flange.
Blind/Line Blind	A blind is a solid plate, usually fitted with a tab to aid identification, handling, and removal, inserted between two flanges to achieve a form of positive isolation. Also referred to as a Spade. See Figure 4-1. Note: Not considered as secure as physical disconnection due to potential hidden corrosion of blind.
Blind Flange	Circular plate bolted to flange at end of line and fitted with gasket to achieve positive isolation (physical disconnection). Also referred to as a Blank Flange.
"Bump Start"	See Try-Out.
Cap	A female screwed fitting (typically small bore) that achieves positive isolation (physical disconnection) by screwing onto an externally threaded section at the end of a pipe, on a drain/bleed valve, or on a piece of equipment. See Plug.

Term	Definition
Car Seal	A metal or plastic cable attached to a piece of equipment (typically a valve) that shows it should not be moved without proper authorization. While it is intended to be strong enough to prevent operation of the valve, it is not as robust as, for example, a padlock. See LOTO.
Checklist	A list of items or steps requiring verification of completion; typically, a procedure format in which each critical step is marked off (or otherwise acknowledged/verified) as it is performed (CCPS 2019).
Decontamination	Process of removal of substance(s) from equipment so that it can be worked on/disassembled without presenting a safety risk to personnel or the environment.
Decommissioning	Completely de-inventorying all materials from a process unit and permanently removing the unit from service (CCPS 2019).
De-isolation	Removing the items/devices that are excluding the sources of energy at defined points.
Design Pressure	The maximum pressure that the equipment is designed to contain, used by the mechanical designer to size the pressure-containing parts. This will typically be at or above the maximum operating pressure of the equipment.
Double Block and Bleed (DB&B)	Closure of two valves with a valved vent or drain between them. This configuration allows for the release of trapped pressure, fluid, or gas between the two blocked valves, providing an added assurance of isolation.
Energy Source	In the context of isolation from an energy source for maintenance, this could include electricity, hazardous chemicals, water, steam, pneumatic pressure, hydraulic pressure, temperature (high and low), mechanical or potential energy, radioactive materials, among others.

Term	Definition
Energy Isolation Plan (EIP)	A document that shows steps to be taken and verifications required to prevent the accidental release of energy when work is to be conducted on a process, plant, or equipment.
First Line Break	Initial, controlled opening of a line or vessel that may contain a source of energy.
Flammable	Subject to combustion if exposed to an ignition source. Per NFPA: Capable of burning with a flame. Dusts, gases, and vapors if in a confined area, can potentially explode.
Hazard Identification and Risk Analysis (HIRA)	A collective term that encompasses all activities involved in identifying hazards and evaluating risk at facilities, throughout their life cycle, to make certain that risks to employees, the public, or the environment are consistently controlled within the organization's risk tolerance (CCPS 2019).
Inspection, Testing and Preventive Maintenance (ITPM)	Scheduled proactive maintenance activities intended to (1) assess the current condition and/or rate of degradation of equipment, (2) test the operation/ functionality of equipment, and/or (3) prevent equipment failure by restoring equipment condition.
Isolation	Means of preventing a release of energy beyond a defined point.
Job Safety Analysis (JSA)	A procedure that systematically identifies: 1) job steps, 2) specific hazards associated with each job step, and 3) safe job procedures associated with each step to minimize accident potential. Also called job hazard analysis (CCPS 2019).
Lock-Out-Tag-Out (LOTO)	A safe work practice in which energy sources are positively blocked away from a segment of a process with a locking mechanism and visibly tagged as such to help ensure worker safety during maintenance and some operations tasks (CCPS 2019).
Leaks by (of valve)	Fluid flowing from the high pressure side through the internals of a valve to the lower pressure side, also referred to as “passing”.

Term	Definition
Leak Test	Pressurizing equipment (typically up to maximum operating pressure) using a liquid or gas (e.g., nitrogen, helium), while observing for leaks; this may include a soapy water test, "sniffer", or monitoring a drop in pressure.
Life Saving Rules	A series of key instructions that cannot be broken, which target some of the key causes of injuries and fatalities in the process industries.
Long-term Isolation	Prolonged isolation of equipment during an extended timeframe (e.g., over 90-days). This often involves comprehensive measures and controls to maintain the isolation status over a longer timeframe compared to standard LOTO procedures, This may include additional measures (preservation plans), operator checks, and MOC.
Loss of Primary Containment (LOPC)	An unplanned or uncontrolled release of material from primary containment, including non-toxic and non-flammable materials (e.g., steam, hot condensate, nitrogen, compressed CO_2 or compressed air) (CCPS 2019).
Management of Change (MOC)	A management system to identify, review, and approve all modifications to equipment, procedures, raw materials, and processing conditions, other than replacement in kind, prior to implementation to help ensure that changes to processes are properly analyzed (for example, for potential adverse impacts), documented, and communicated to employees affected (CCPS 2019).
Maximum Allowable Working Pressure (MAWP)	Maximum pressure at specific temperature at which the vessel can safely function.
Mothballed	Taken out of service, usually disconnected (see Long-term Isolation) and preserved, with the intention of re-using/reinstating the equipment/process at a later date.