



Operational Excellence Services

Operation
CASTOR®



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CASTOR[®] (Commissioning and Startup Transient Operability Review)

Do you have any of these issues?

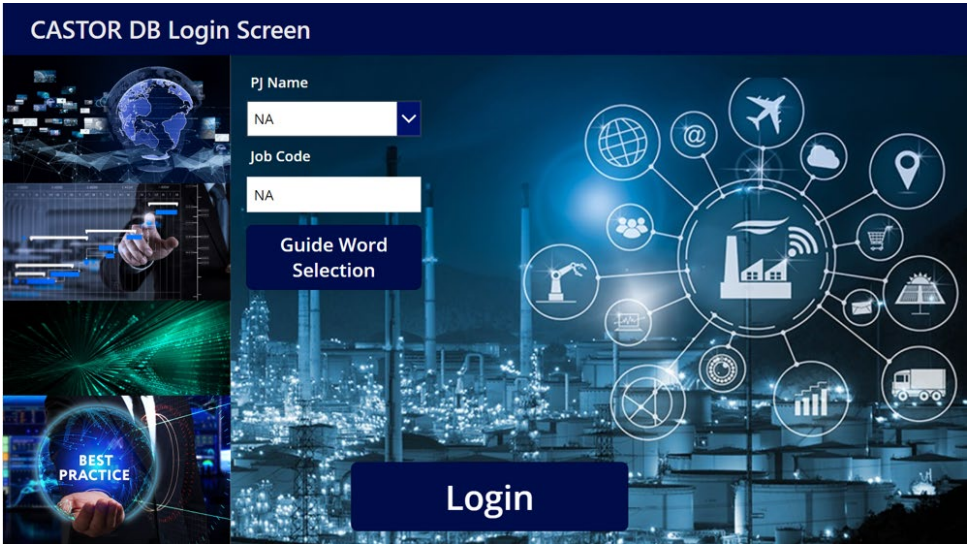
- Concerns on Commissioning and Startup Plan
- Lack of (or No) Experience in Plant Startup
- Introduction of Unfamiliar Equipment/Unit

Issue Scenarios	Failure Scenarios	Startup modes	Operational modes	Special modes	Process Production Modes	Non-Production/Temporary Modes	Special Scenarios	Commissioning Tests / Modes	Commissioning Tests / Modes	Start up Tests / Modes
Embarkment/Low temperature	Main process trips	Cat activation	Thermal expansion/contraction	Recycle modes	Product Load mode	Recycle modes	Heavy rain/snow	Equipment internal (boasting)	Steam blow	Unfamiliar parts/lightness test
Over temperature	Main comp trips	Cat re-juvination	Controls on manual	Blank removal gas-off	Product hold mode	Chrysal mode (static)	Tidal/Waves	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
Overfill	Loss of catalyst	Cat regen	Heavy rain/snow	Blank removal - H2 H2	Other feed flow Modes	Chrysal mode / min firing mode	Cyclone	Instrument Loop test	Chemical clean run	ESD/TSO valve test
Over pressure	Internal leaks/fill (e.g. safe shutdown)	Reactor switch	ESD/TSO valve	Distillation mode	Other feed flow Modes	Steam out mode	Day-Night swing	Mixer test	ESD/TSO valve test	ESD/TSO valve test
Back flow	Feed equipment failure (over/under/leakage)	Cat Circulation	Cyclone/best storm	Stripping & reduction mode	Equipment bypass / trickle mode	Firing modes	Floods (land side)	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
Vapour breakthrough	Instrument failure	Coking/Decoking	ESD/TSO valve	ESD/TSO valve	Batch operation	ESD/TSO valve	Lightning strike	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
Vacuum fling/emptying	Internal failure	Shipping	Day-Night swing	Regen. Mode	Regen. Mode	Off-spec modes	Natural disasters	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
Flaring/emission	Falling P/ID valve	Cat make up/adjust	Water error	Steam out mode	Online flushing / clean modes	Pigging mode	Heat/Smoke/Dust storm	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
Impurity/leakage	Cracking / catalyst thermal stress, etc.	Off-spec Reactor mode (C modes)	Competence	Depressure/brown modes	Depressure/brown modes	Vacuum unload	Natural disasters	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
Off-spec product	Fatigue	Reaction / run away / pre-heat	PP's	Off-spec (modes)	Off-spec (modes)	Test modes e.g. H2/ESD/TSO test	High humidity	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
Composition different	Loss of H2	Cat make up/adjust	High Involvement	High Involvement	High Involvement	Manual modes	High humidity	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
Hydrates/Freeze-out	Loss of heating	Cat make up/adjust	High Involvement	High Involvement	High Involvement	Manual modes	High humidity	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
Water explosion	Loss of cooling	Cat make up/adjust	High Involvement	High Involvement	High Involvement	Manual modes	High humidity	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
CO ingress (e.g. vacuum, back flow)	Loss of steam	Cat make up/adjust	High Involvement	High Involvement	High Involvement	Manual modes	High humidity	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
pH issues	Loss of FG	Cat make up/adjust	High Involvement	High Involvement	High Involvement	Manual modes	High humidity	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
Strainer	Loss of water	Cat make up/adjust	High Involvement	High Involvement	High Involvement	Manual modes	High humidity	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
Solid Polymer/Polymer	Loss of chemicals	Cat make up/adjust	High Involvement	High Involvement	High Involvement	Manual modes	High humidity	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
Thermal Degradation	Loss of catalyst	Cat make up/adjust	High Involvement	High Involvement	High Involvement	Manual modes	High humidity	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
Reaction during start up (e.g. below the start)	Loss of H2	Cat make up/adjust	High Involvement	High Involvement	High Involvement	Manual modes	High humidity	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
Overpressure/spark	Loss of product	Cat make up/adjust	High Involvement	High Involvement	High Involvement	Manual modes	High humidity	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
Passing RV	Loss of feed	Cat make up/adjust	High Involvement	High Involvement	High Involvement	Manual modes	High humidity	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
Prime issues (degad, conc.)	Loss of Power	Cat make up/adjust	High Involvement	High Involvement	High Involvement	Manual modes	High humidity	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
Foaming	Loss of Air	Cat make up/adjust	High Involvement	High Involvement	High Involvement	Manual modes	High humidity	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
Load carry over	Loss of heating	Cat make up/adjust	High Involvement	High Involvement	High Involvement	Manual modes	High humidity	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
Corrosion	Loss of H2	Cat make up/adjust	High Involvement	High Involvement	High Involvement	Manual modes	High humidity	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
Minimum noise/flow	Loss of catalyst	Cat make up/adjust	High Involvement	High Involvement	High Involvement	Manual modes	High humidity	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
High velocity / Fall	Loss of feed	Cat make up/adjust	High Involvement	High Involvement	High Involvement	Manual modes	High humidity	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test
Thermal expansion/contraction	Loss of steam	Cat make up/adjust	High Involvement	High Involvement	High Involvement	Manual modes	High humidity	ESD/TSO valve test	ESD/TSO valve test	ESD/TSO valve test

CASTOR Guideword Template (General)

CASTOR[®] Solution

- Reveal risks during transient state operation at commissioning and initial startup phase
- Plan mitigation actions against risks
- Increase likelihood of successful commissioning and plant startup
- Minimize downtime due to trouble
- Eliminate risks of schedule delay

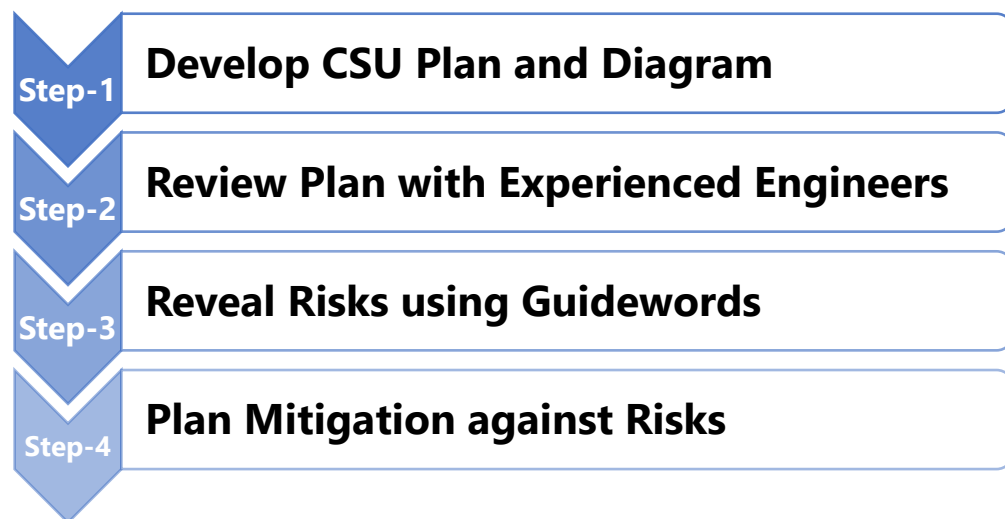


CASTOR Database



Workflow & Results

Workflow of CASTOR®



- Develop Commissioning and Startup (CSU) Plan and Diagram
- Review CSU Plan and Diagram with highly experienced engineers
- Reveal risks related to transient operation during Commissioning and Startup using Guidewords and experiences of engineers
- Plan mitigation actions against revealed risks
- Improvement of Operation Manuals, Procedures (SOP), Training Programs and updating of procedures for existing plants

Our Strengths

- Professional Process & Commissioning Engineer Teams
- World-class experiences and expertise in Plant Commissioning and Startup as an EPC Contractor
- A wealth of Lessons Learned about Commissioning and Startup
- Experiences in various types of plant like LNG, Refinery, NGL, GOSP, Floating LNG, Chemical, etc.

Our Experiences

- CASTOR® for LNG, NGL, GOSP, Floating LNG, Ethylene, etc.
- Not only for EPC but also for FEED projects
- Long history of startup review as the predecessors of CASTOR®

== > **CASTOR Database**



CASTOR®
Since 2015
7 Cases