



Operational Excellence Services

Operation
CASTOR®



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

Do you have any of these issues?

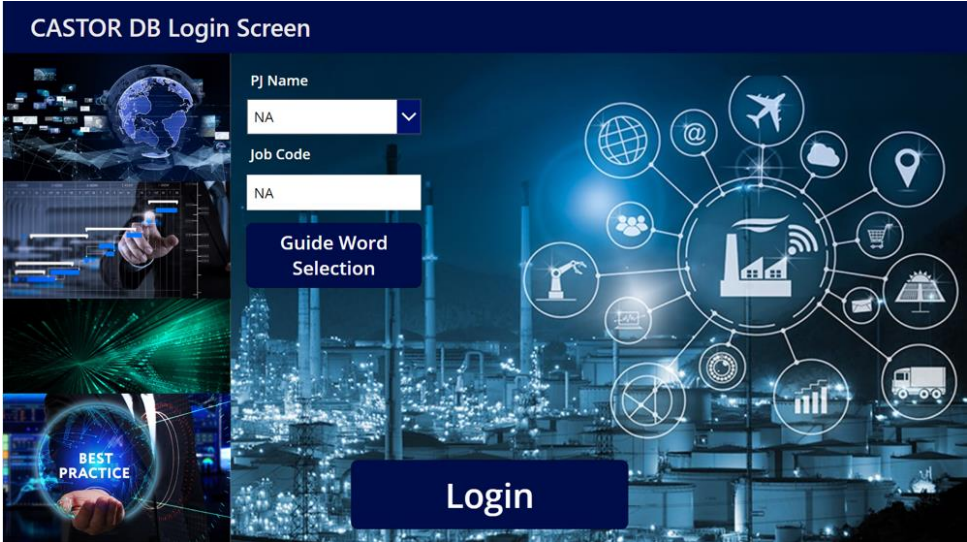
- Concerns on Commissioning and Startup Plan
- Lack of (or No) Experience in Plant Startup
- Introduction of Unfamiliar Equipment/Unit

Good Scenarios	Failure Scenarios	Startup modes	Over issues	Special modes	Specific Production Modes	New modes/Temporary Modes	Startup Scenarios	Commissioning Tests / Modes	Commissioning Tests / Modes	Start up Tests / Modes
Embriement/Low temperature	Main process trips	Cut activation	Thermal expansion/contraction	Recycle modes	Product Load mode	Recycle modes	Heavy rain/snow	Equipment internal (loadings)	Steam blow	Unleaded joints tightness test
Over temperature	Main comp trips	Cut re-juvination	Controls on manual	Blank removal gas-oil shift	Product hold mode	Blank removal - H2 H2 separator	Tidal/Waves	ESD/TSD valve leak test	Safe (motor)runs	Surge tests on compressor
Overfill	Loss of containment /Leads	Cut regen	Heavy rain/snow	Other feed flow Modes	Chrynd mode / min firing mode	Chrynd mode / min firing mode	Cyclone	Instrument Loop test	Chemical clean run	Pumps tests not able to test on benign fuel
Over pressure	Internal leaks/fail (e.g. high catalyst)	Reactor switch	Reactor switch	Distillation mode	Steam out mode	Steam out mode	Magnum test	Water test	Turbo expander tests	
Back flow	Feed equipment failure (preheating/heat exchangers/boilers)	Cut Circulation	Cyclone/burst storm	Ising & reduction mode	Equipment bypass / trickle mode	Ising modes	Day-Night swing	Drains clearing	Compressor tests not able to test on benign fuel	
Vapour breakthrough	Instrument failure	Coking/Decoking	ESD writer / Wastewater	Reactor leave heating & cooling	Batch operation	Depressure down mode	Floods (land slide)	Special cleaning (Comp. Pack.)	Equipment test not able to test on benign fuel	
Vacuum filling/emphying	Internal failure	Stripping	Day-Night swing	Catalyst drying	Regen. Mode	Offspec modes	Lightning strike	High humidity	Internal tightness test at HCP	DM tests
Flaming/ignition	Partial RH/Leads	Cut make up/agent	Human error	Steam out mode	Online flushing clean modes	Pigging mode	Reactor/Smoke/Dust storm	Water flush (for deposits)	Min. filling	Melting tests
Cracking issues/thermal stress, etc.)	Cracking issues/thermal stress, etc.)	Off-spec Reactor modes (C modes)	Competition	Depressure/burnout mode	Specific Maint. Modes	Vacuum unload	Natural disasters	Drains clearing	Refactory Dryout	ESD trip tests
Offspec product	Partial	Reaction / run away / pre-heat	PP's	Offspec (modes)	High inventory	Test modes e.g. air compressor test	High humidity	Special cleaning (Jap. Black removal)	Static Dryout	Other tests not able to test on benign fuel
Composition different	Loss of NG	Cut feed ratio				Manual modes		Valve Stroke test	NG / Air run	Final testing
Hydrates/Free-output	Loss of heating	Coke Flare/ignition				1st year maint.		Dry function test	Water run	Turndown test
Water explosion	Loss of cooling	Cut/CO2 issues (e.g. backflow issues)				Online routine maintain. Modes		Cat loading	Chemicals run	Performance test
CO2 ingress(e.g. vacuum, back flow)	Loss of steam	Backflow issues				Cat changeout		Preservation	Special circulation run	Other tests
pH issues	Loss of FG	Incompatible components				Chemical changeout		Low pressure Leak test	Electrical test	ENG Liquid/MR Turbine start up
(strainer) Solid/Polymer/Plugging/Signs	Loss of water	Cut plugging				Preservation mode		PPV test	West fan test	
Thermal Stress/Decompost	Loss of chemicals	Cat Regen issues				Special inspections		Other tests	Complex loop test	
Vacuum during start up (e.g. below the roof)	Loss of air/gas	Uninspected side reactions				Special cleaning (decom. tests)		Large bore pipe cleaning	Large bore pipe cleaning	
Coating	Loss of H2O2	Reaction conv. Loss								
Overpressure/spark	Loss of dry/dryness	PPV test								
Passing RV	Loss of feed/dry	Attention/operation								
Reactor issues (degrad. conc.)	Loss of Power	RV design for upset cases								
Foaming	Loss of Air	Catalyst within tested range								
Leads carry over	Loss of drying	High loads								
Overheating	Loss of H2O2	Cat. Heat line issues								
Viscosity noise/flow/pulse	Loss of safety	Particle distribution issues								
Phase separation / Feed	Loss of catalyst	Particle distribution issues								
Thermal expansion/contraction	Loss of catalyst	Particle distribution issues								

CASTOR Guideword Template (General)

CASTOR[®] Solution

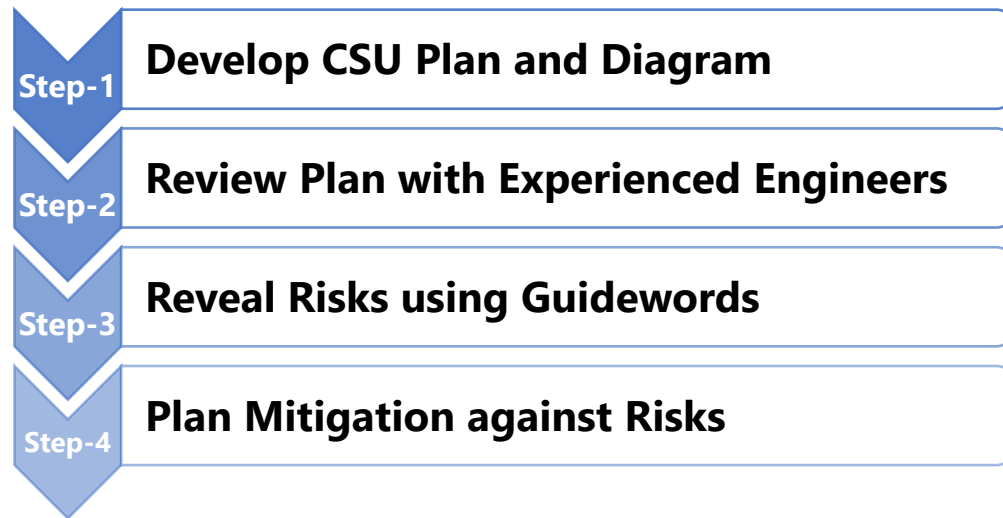
- Reveal risks during transient state operation at commissioning and initial startup phase
- Plan mitigation actions against risks
- Increase likelihood of successful commissioning and plant startup
- Minimize downtime due to trouble
- Eliminate risks of schedule delay



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
15 Cases