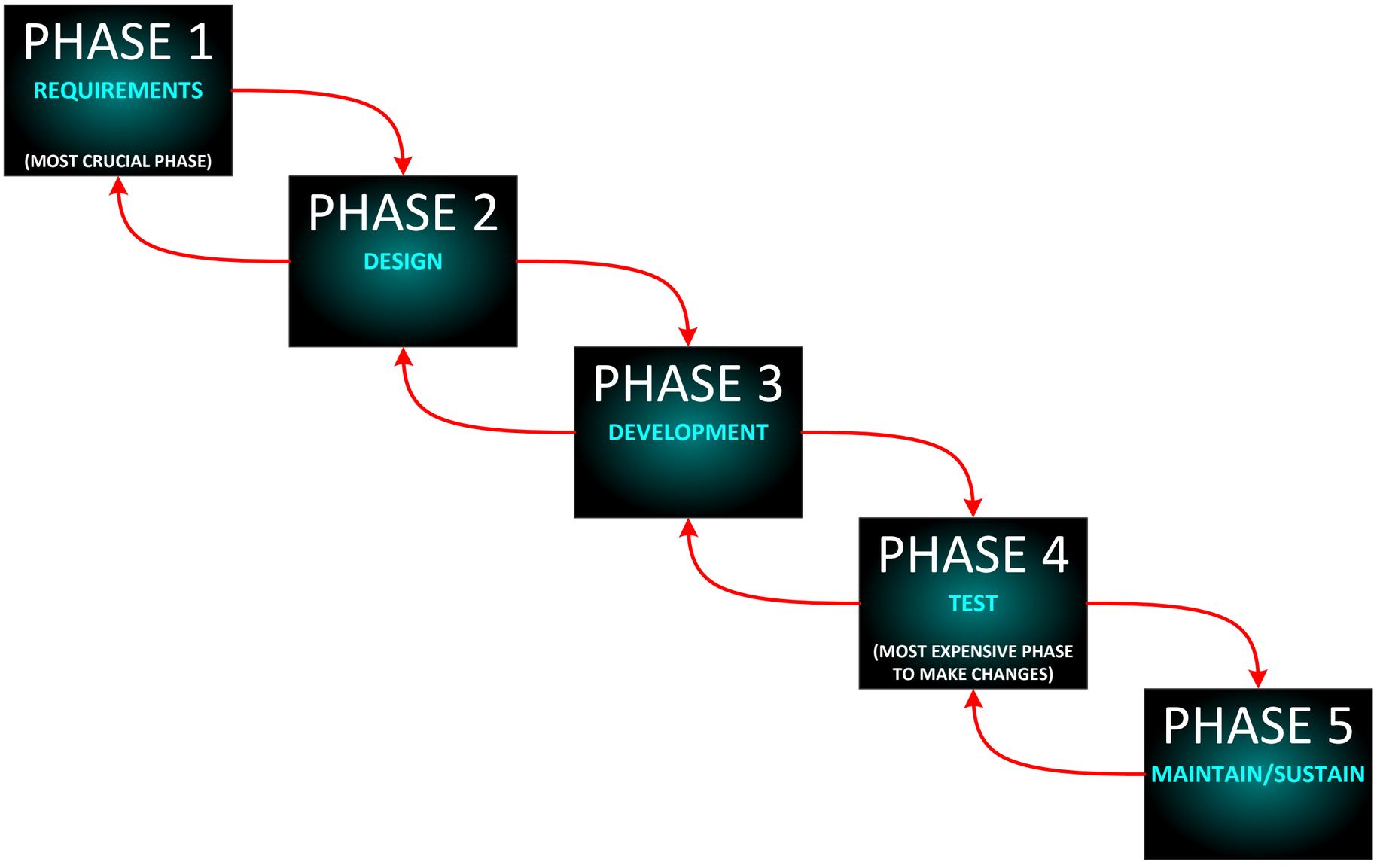
KZ Controls LLC

SYSTEM DEVELOPMENT LIFECYCLE

Using a Modified Waterfall Lifecycle Model



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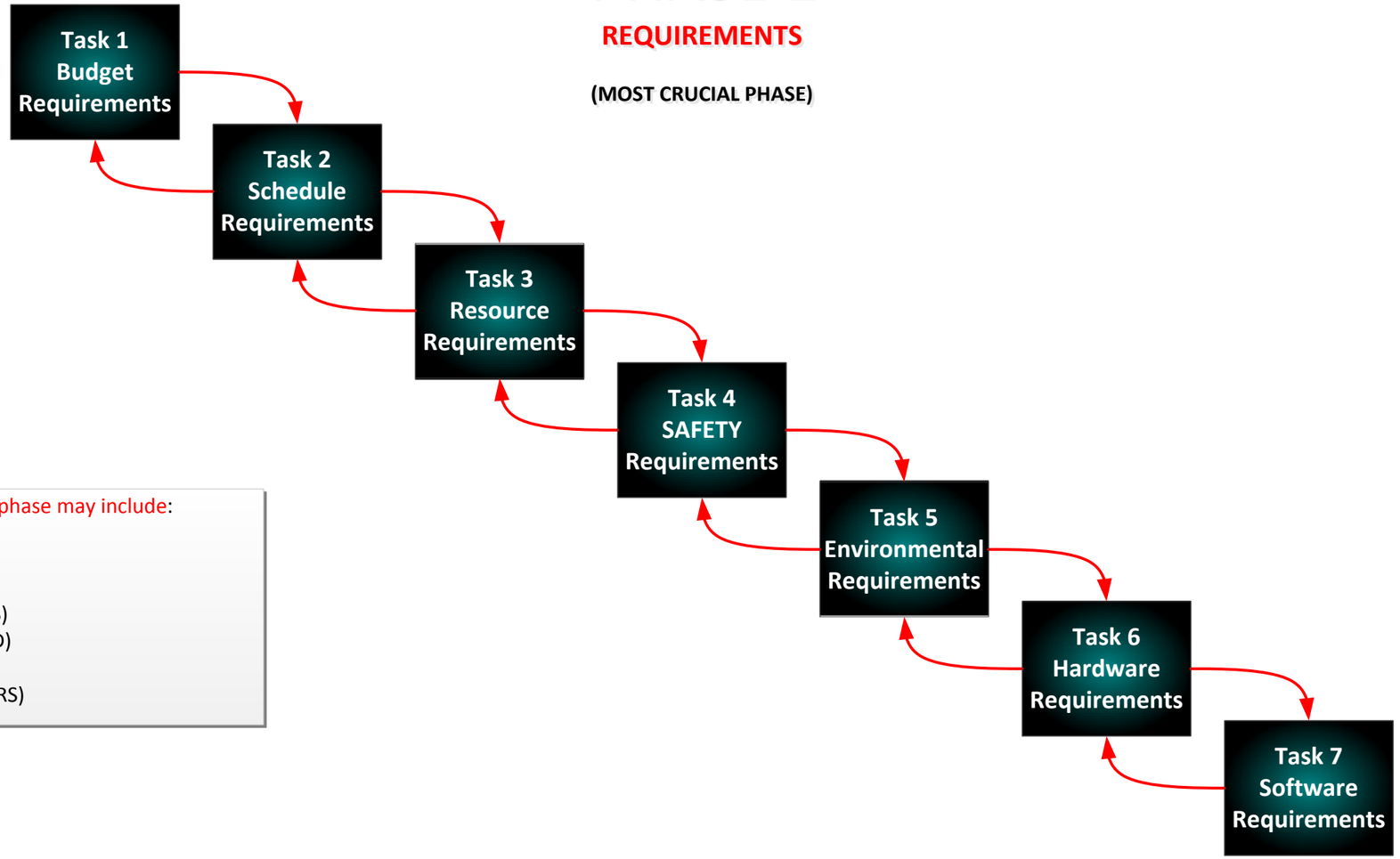
PHASE 1

REQUIREMENTS

(MOST CRUCIAL PHASE)



Typically, documentation created in this phase may include:
Requirements Document
Project Requirements Document
System Requirements Document (SRD)
System Requirements specification (SyRS)
Functional Requirements Document (FRD)
Product Requirements Document (PRD)
Software Requirements Specifications (SRS)

Budget Requirements = Determine available budget(s), hardware budget, labor budget, outsourcing budget, how much should be saved for unforeseen issues, etc...

Schedule Requirements = Determine deadlines, milestones, progress reporting, etc...

Resource Requirements = Determine people available, skills available, outsourcing restrictions, geographical complications, potential communication issues, materials/equipment already available, etc...

SAFETY Requirements = INVOLVE HEALTH, SAFETY, AND ENVIRONMENTAL PERSONNEL!!! Determine hazards, operator safety, environmental safety, equipment safety, and ways to prevent incidents, regulations to follow, etc…

Environmental Requirements = INVOLVE HEALTH, SAFETY, AND ENVIRONMENTAL PERSONNEL!!! Determine effects of safety concerns on the environment and how to preventive measures (primary and secondary containment, vent hoods, scrubbers, regulations, etc…)

Hardware Requirements = Determine hardware/equipment that will meet the safety and environmental requirements, maintenance friendliness (calibration requirements and preventive maintenance requirements), and functionality needed (measurement rates, standards/protocols, standards and protocols, network, electronics, sensors, apparatus, connections, wire insulation, solder, computer, keyboard, mouse, monitor, enclosures, dimensions, structures, etc…)

Software Requirements = Determine software needs such as user-friendliness and functionality (recording/logging rates, standards/protocols, memory usage, upgradeability/scalability, flexibility, maintainability, protocols, etc…)

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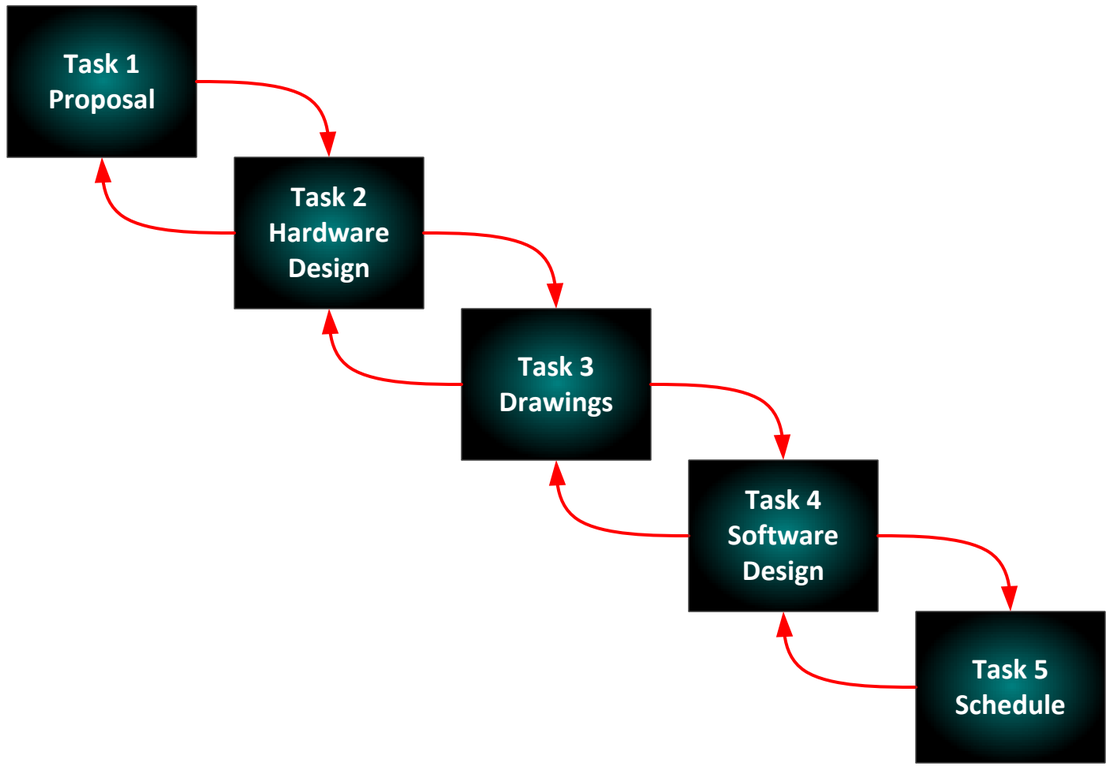
PHASE 2

DESIGN



Typically, documentation created in this phase may include:
Proposal/itemized proposal
Project Plan
Process and Instrumentation Diagram (P&ID)
Basic Block Diagrams
Wiring Diagrams
Circuit Schematics
Circuit Layout
Mechanical/Dimensional Drawings
Structural Drawings
Flowcharts
State Diagrams
Technical Manual (Tech Manual)
Engineering Manual/Handbook
GANTT Chart

Proposals = Create/Get internal/external cost/schedule estimates, AVOID ASSUMPTIONS when estimating and always expect/prepare for complications (AVOID ASSUMPTIONS – revisit requirements if necessary to solidify EVERYONES understanding of the needs and expectations BEFORE starting development), begin outsourcing if necessary, etc...

Hardware Design = design hardware/equipment that will meet the requirements (user interface, data acquisition equipment/rates, control equipment/rates, process equipment, skids, frames, brackets, apparatus, sensors, enclosures, electronics, power, standards/protocols, network equipment, etc…)

Drawings = create and verify drawings that meet the requirements (Process & Instrumentation Diagram or P&ID, mechanical drawings, wiring diagrams, electronic schematics, electronic layouts, etc…)

Software Design = design software that meets the requirements (architectures, user interface, parallelism, CPU usage, data acquisition rates, control rates, logging rates, formats, standards/protocols, memory usage, upgradeability, flexibility, maintainability, etc…)

Schedule = create schedules that meet requirements (GANTT chart, project plans, milestones, deadlines, progress reports, etc…)

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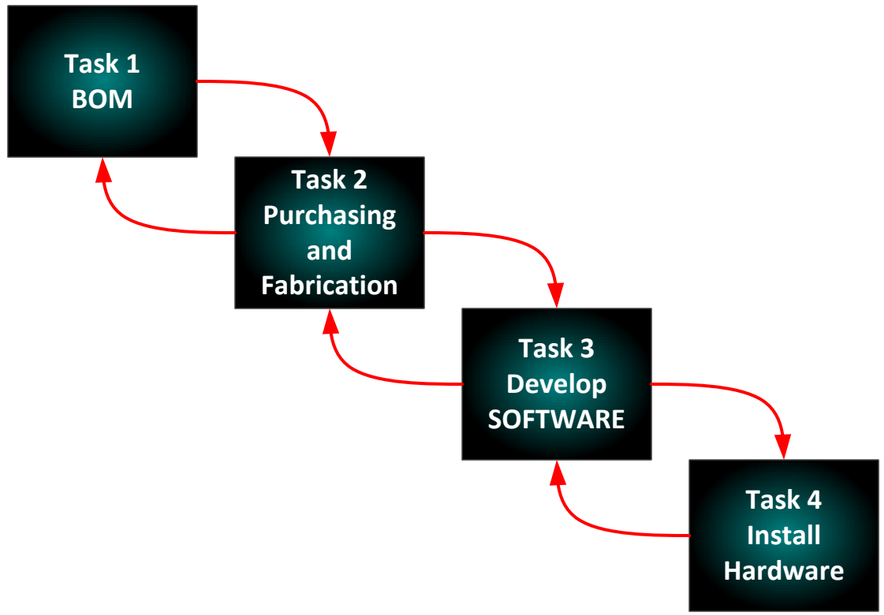
PHASE 3

DEVELOPMENT



Typically, documentation created in this phase may include:
Bill of Materials (BOM)
Parts List
Progress Reports

BOM = create and verify Bill of Materials that meet requirements and designs (parts lists, material costs, non-labor costs, etc…)

Purchasing and Fabrication = requisition parts/components/modules/units/subsystems and begin fabricating parts/components/modules/units/subsystems that meet the requirements and designs (outsource fabrication if necessary, as long as the requirements and designs are understood BEFORE fabrication – Make it very clear to the vendor to ask questions instead of assuming – DO NOT DESIGN/FABRICATE BASED ON ASSUMPTIONS!!!)

Develop Software = develop software to meet the requirements and designs

Install Hardware = install/build/assemble/integrate hardware to meet the requirements and designs

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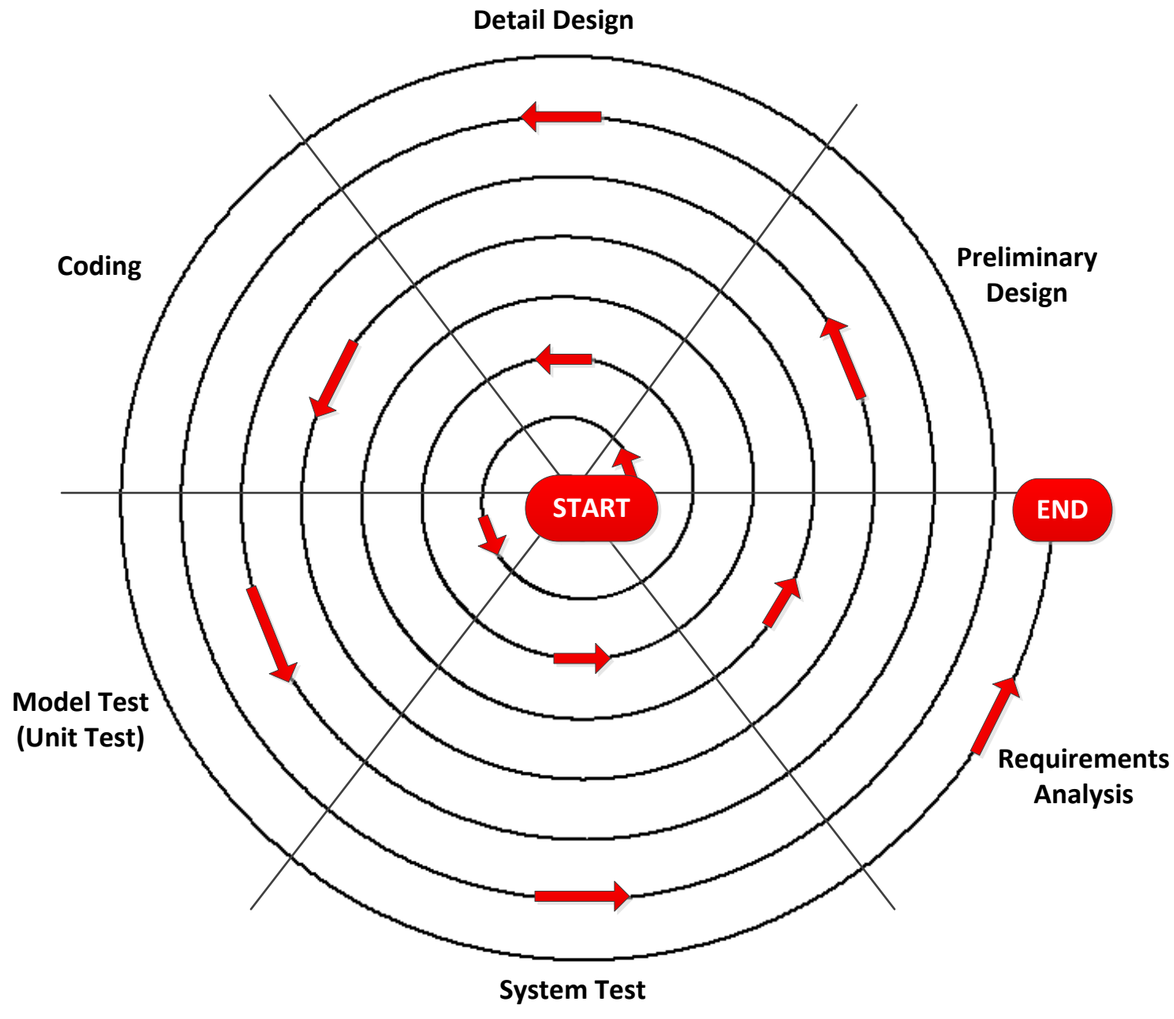
SOFTWARE DEVELOPMENT METHOD
Using a Spiral Development Model



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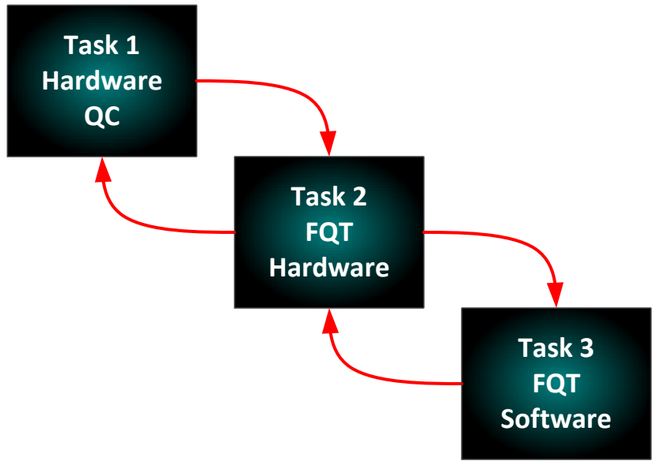
PHASE 4

TEST

(MOST EXPENSIVE PHASE TO MAKE CHANGES)



Typically, documentation created in this phase may include:
Final Quality Test (FQT)
Factory Acceptance Test (FAT)
Site Acceptance Test (SAT)
Acceptance Test
Quality Assurance Test
Quality Control Test
Project Reports

HW QC = Inspect the hardware to verify requirements and designs were met BEFORE testing

FQT HW = create a final quality test procedure to verify that the hardware meets all requirements and design specifications (a.k.a. Final Acceptance Test, a.k.a. Site Acceptance Test, a.k.a. Factory Acceptance Test, etc…) Test and debug the hardware

FQT SW = create a final quality test procedure to verify that the hardware meets all requirements and design specifications (a.k.a. Final Acceptance Test, a.k.a. Site Acceptance Test, a.k.a. Factory Acceptance Test, etc…) Install, test, and debug the software

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PHASE 5

MAINTAIN/SUSTAIN

Typically, documentation created in this phase may include:
Operator Manual (Op Manual)
Installation Guide
Quick Startup Guide
Instruction Manual
Preventive Maintenance Schedule (PMS)
Calibration Schedule
Trouble Reports

Training = Operating instruction

PMS = Preventive Maintenance Schedule (includes calibration)

CM = Corrective Maintenance

Upgrades = Updated versions hardware/software

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SYSTEM DEVELOPMENT LIFECYCLE

Using a Modified Waterfall project development model

PHASE 1

REQUIREMENTS

(MOST CRUCIAL PHASE)

Task 1 Budget Req

Task 2 Schedule Req

Task 3 Resource Req

Task 4 SAFETY Req

Task 5 Enviro Req

Task 6 HW Req

Task 7 SW Req

Budget Req = budget(s) available
Schedule Req = deadlines requirements
Resource Req = resources requirements
SAFETY Req = safety requirements
Enviro Req = environmental requirements
HW Req = hardware/equipment requirements
SW Req = software requirements

Typical documentation may include:
Requirements Document
Project Requirements Document
System Requirements Document (SRD)
System Requirements specification (SyRS)
Functional Requirements Document (FRD)
Product Requirements Document (PRD)
Software Requirements Specifications (SRS)

PHASE 2

DESIGN

Task 1 Proposal

Task 2 HW Design

Task 3 Drawings

Task 4 SW Design

Task 5 Schedule

Proposals = Create/Get estimates
HW design = design hardware/equipment that will meet the requirements
Drawings = create and verify drawings that meet the requirements
SW design = design software that meets the requirements
Schedule = create schedules that meet requirements

Typical documentation may include:
Proposal/itemized proposal
Project Plan
Process and Instrumentation Diagram (P&ID)
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Wiring Diagrams
Circuit Schematics
Circuit Layout
Mechanical/Dimensional Drawings
Structural Drawings
Flowcharts
State Diagrams
Technical Manual (Tech Manual)
Engineering Manual/Handbook
GANTT Chart

PHASE 3

DEVELOPMENT

Task 1 BOM

Task 2 Purchasing and Fabrication

Task 3 Develop SW

Task 4 Install HW

BOM = create and verify Bill of Materials that meet requirements and designs
Purchasing and Fabrication = requisition parts/components/modules/units/ subsystems and begin fabricating parts/ components/modules/units/subsystems that meet the requirements and designs
Develop SW = develop software to meet the requirements and designs
Install HW = install/build/assemble/ integrate hardware to meet the requirements and designs

Typical documentation may include:
Bill of Materials (BOM)
Parts List

PHASE 4

TEST

(MOST EXPENSIVE PHASE TO MAKE CHANGES)

Task 1 HW QC

Task 2 FQT HW

Task 3 FQT SW

HW QC = Inspect the hardware
FQT HW = Final quality testing hardware
FQT SW = Final quality test software

Typical documentation may include:
Final Quality Test (FQT)
Factory Acceptance Test (FAT)
Site Acceptance Test (SAT)
Acceptance Test
Quality Assurance Test
Quality Control Test
Project Reports

PHASE 5

MAINTAIN/SUSTAIN

Training = Operating instruction
PMS = Preventive Maintenance Schedule (includes calibration)
CM = Corrective Maintenance
Upgrades = Updated versions hardware/software

Typical documentation may include:
Operator Manual (Op Manual)
Installation Guide
Instruction Manual
Preventive Maintenance Schedule (PMS)
Calibration Schedule
Trouble Reports